WORLD PETROLEUM

MAR 21 1947

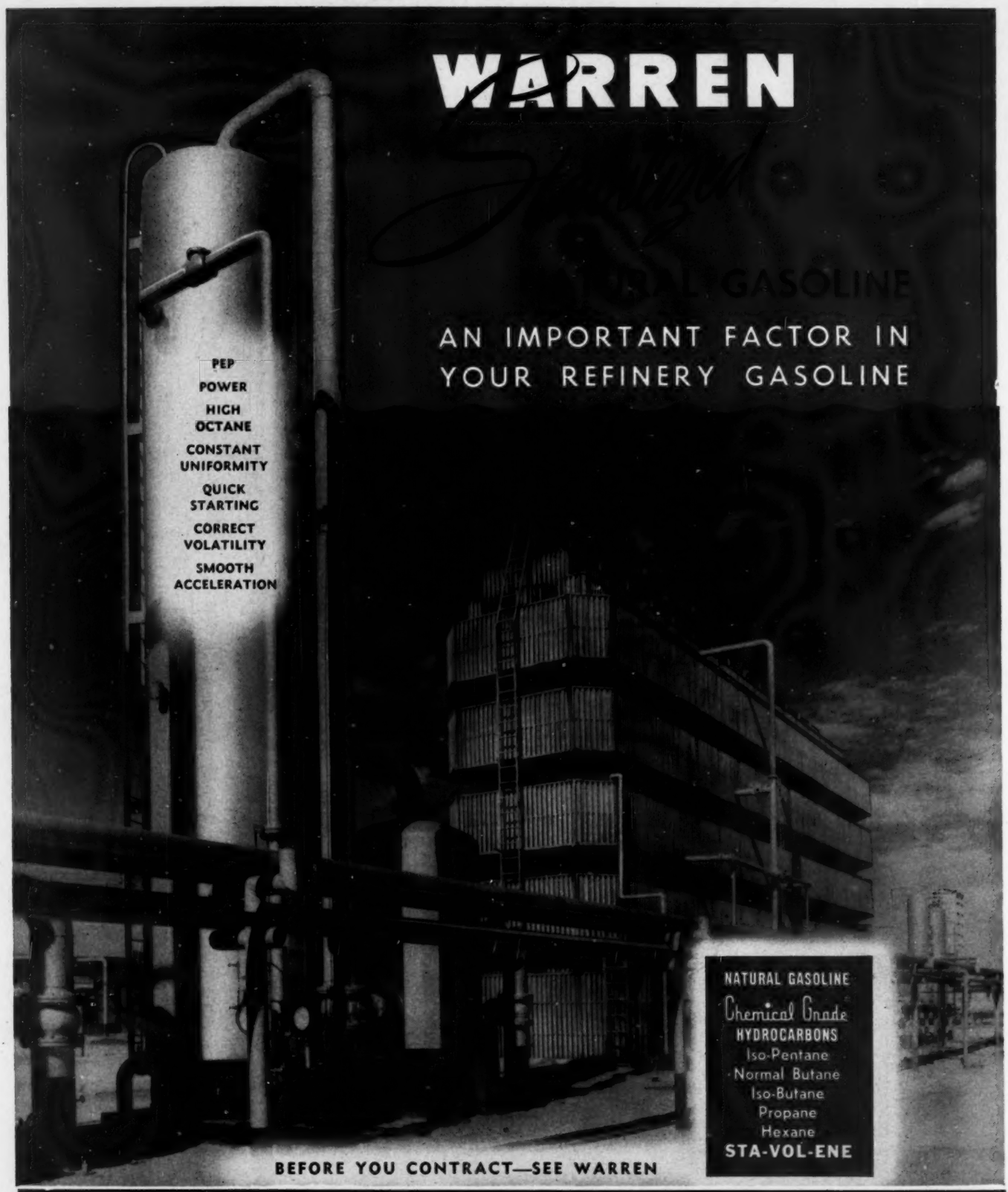
Science Library

MARCH, 1947 FIVE DOLLARS PER YEAR FIFTY CENTS PER COPY

WARREN

Just Natural GASOLINE

AN IMPORTANT FACTOR IN
YOUR REFINERY GASOLINE



BEFORE YOU CONTRACT—SEE WARREN

SILVER ANNIVERSARY 1922 YEAR 1947

Warren Petroleum Corporation

"Just Natural Gasoline and Its By-Products"

Manufacturers, Exporters and Marketers of Natural Gasoline and Liquefied Petroleum Gas

Tulsa 2, Oklahoma

CABLE ADDRESSES: Stavolene, Warren

Export Terminals: Corpus Christi, Port Arthur, Baytown, Texas City, and Norsworthy, Houston, Texas; Lake Charles, La.; Marcus Hook, Pa.

WORLD PETROLEUM

PUBLISHED BY MONA PALMER

THE MANAGEMENT PUBLICATION OF THE INTERNATIONAL PETROLEUM INDUSTRY

Rex W. Wadman
General Manager

E. W. Mayo
Editor

J. C. Chatfield
Managing Editor

Robert W. Cowan
Art Director

SUBSCRIPTIONS

Annual subscription $5.00 (U. S.) postpaid
Single copies 50 cents

GENERAL OFFICES

2 West 45th Street, New York 19, N. Y.
(Tel. MUrray Hill 2-7333)

BRANCH OFFICES

LONDON: Georgian House, St. James, London S. W. I.

CHICAGO 1: W. R. Cotton, Mid-West Advertising Manager, 307 No. Michigan Ave., *(Tel. Franklin 2508)*

CLEVELAND 14: F. J. Enright, Cleveland Advertising Manager, Union Commerce Bldg., *(Tel. Main 5693)*

DETROIT 2: R. F. Pickrell, Michigan Manager, 314 Stephenson Bldg., *(Tel. Trinity 1-0709)*

LOS ANGELES 14: W. S. Johnson, Western Advertising Manager, 412 West 6th Street, *(Tel. Mutual 1391)*

NEW YORK 19: R. F. Scholbe, Eastern Advertising Manager, 2 West 45th Street, *(Tel. MUrray Hill 2-7333)*

TULSA 3: O. F. Cozier, Mid-Continent Advertising Manager, 515 McBirney Bldg., *(Tel. 4-5555)*

World Petroleum is published by Mona Palmer, Trustee under the will of Russell Palmer

CONTENTS

VOLUME 18 MARCH, 1947 NUMBER 3

Oil Industry and National Security 51
Drilling Activity Expands Around World 52
Marine Exploration Develops New Techniques 57
Magnolia Testing Offshore Formations 60
Petroleum Trends in California 62
1946 Discoveries Balance Production 65
Mexico Pushing Program for Increased Production 66
Automotive Trends 68
Italy's Oil Industry 72
Shell Recompletes California Well 74
Bacteria to Help Produce Oil 76
World Production, 1946 78
Jersey Standard Develops "Third Asset" 79
Senate Committee Stresses Future Role of Synthetics 80
Secretary Krug Discusses Future Supplies 82
International News and Notes 84
Oil Company Changes 88

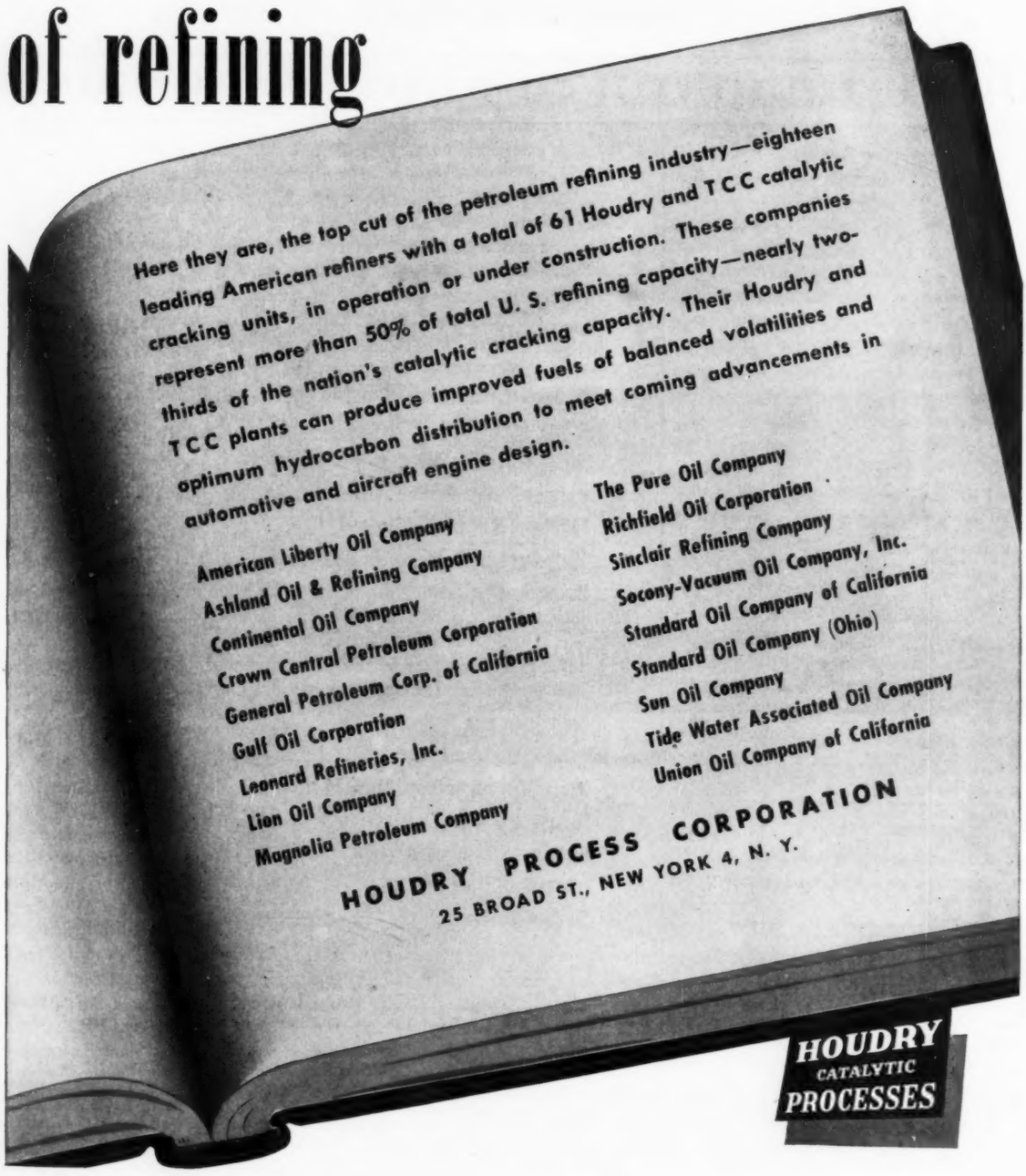
This Month's Cover

Gravity meter crew operating by canoe on the shores of the Mackenzie River in Canada's Northwest Territory. Photograph by Collier for Standard Oil Co. (N. J.)

1946 Annual Index

An index to all issues of WORLD PETROLEUM published in 1946 now is in course of preparation and will be ready for distribution to subscribers soon. Copies will be sent free of charge on request. Please address your card or letter to Editorial Department, WORLD PETROLEUM, 2 West 45th St., New York 19, N. Y.

The list of Houdry licensees is the Blue Book of refining


Here they are, the top cut of the petroleum refining industry—eighteen leading American refiners with a total of 61 Houdry and TCC catalytic cracking units, in operation or under construction. These companies represent more than 50% of total U. S. refining capacity—nearly two-thirds of the nation's catalytic cracking capacity. Their Houdry and TCC plants can produce improved fuels of balanced volatilities and optimum hydrocarbon distribution to meet coming advancements in automotive and aircraft engine design.
American Liberty Oil Company
Ashland Oil & Refining Company
Continental Oil Company
Crown Central Petroleum Corporation
General Petroleum Corp. of California
Gulf Oil Corporation
Leonard Refineries, Inc.
Lion Oil Company
Magnolia Petroleum Company
The Pure Oil Company
Richfield Oil Corporation
Sinclair Refining Company
Socony-Vacuum Oil Company, Inc.
Standard Oil Company of California
Standard Oil Company (Ohio)
Sun Oil Company
Tide Water Associated Oil Company
Union Oil Company of California
HOUDRY PROCESS CORPORATION
25 BROAD ST., NEW YORK 4, N. Y.
HOUDRY
CATALYTIC
PROCESSES

OIL INDUSTRY AND NATIONAL SECURITY

TO the voluminous discussion and vast array of opinion previously devoted to the future of the American oil industry, the Special Senate Committee Investigating Petroleum Resources has now added the results of its prolonged inquiry into the subject. Established in March, 1944, the committee was directed to "make a full and complete study and investigation with respect to petroleum resources and the consumption of petroleum and petroleum products, both within and outside the United States, in their relation to the national welfare and security."

In the eariler period of its inquiry, the attention of the committee was largely directed to consideration of matters relating to the supply of oil products for military use. With the appointment of Senator Joseph C. O'Mahoney as chairman, the committee took up a number of broad topics, including new sources of petroleum in the United States, postwar requirements of the country, the extent of American petroleum interests in foreign countries and the position of independents.

In the course of its extended hearings on these and related subjects, the committee heard from hundreds of men actively connected with the various phases of oil industry operation, from technical experts, directors of research, statisticians and economists, and from representatives of the armed forces of the nation. It has assembled a great mass of factual information supplemented by charts and statistical tables to aid in its interpretation. As a basis for congressional action affecting oil or the determination of a national oil policy, the proceedings of the committee will retain unquestioned value for a long time to come.

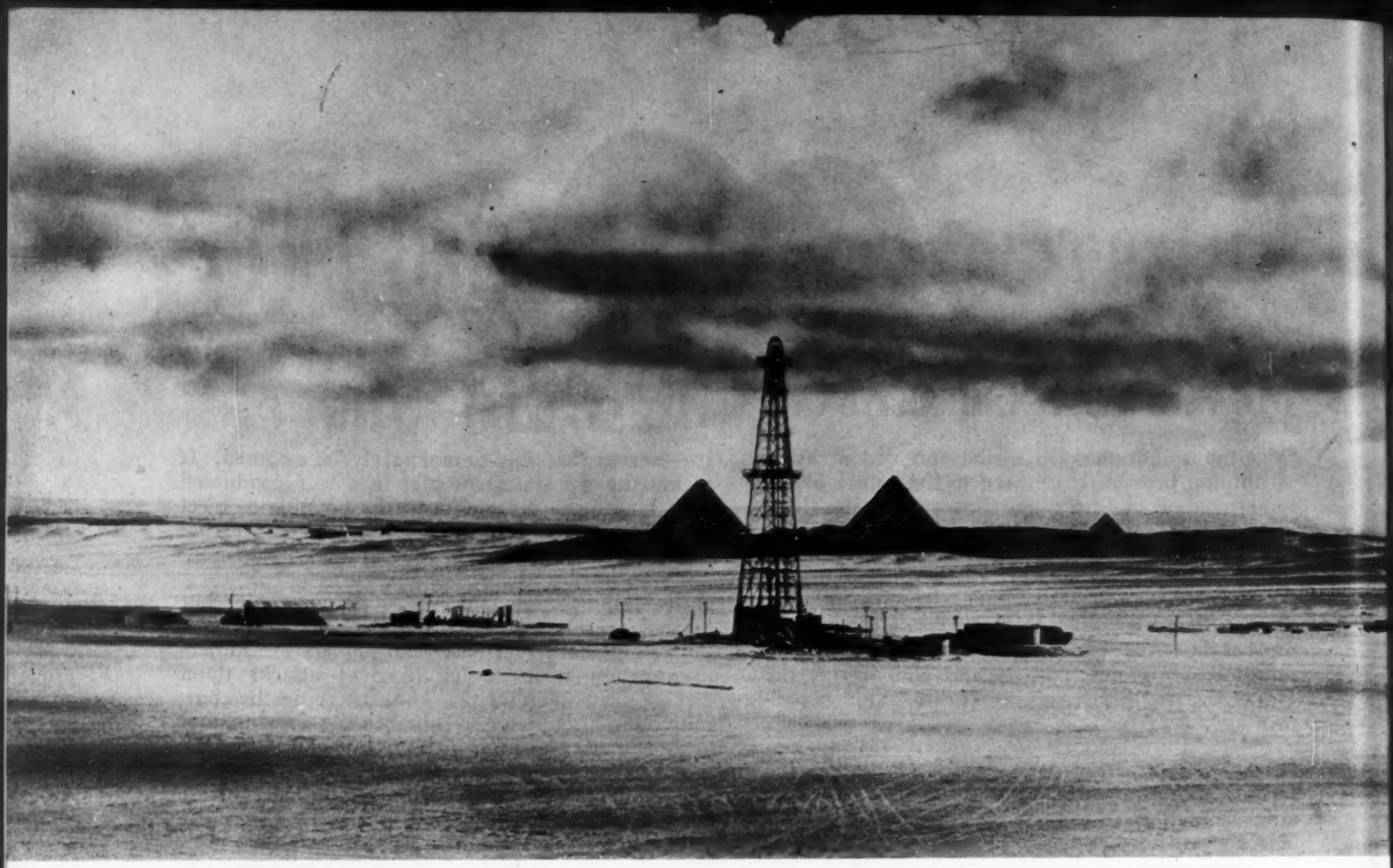
Evaluation of future oil requirements demands consideration from two separate angles. One is the question of providing supplies to meet the rising peacetime demand for petroleum and petroleum products; the other is the problem of national security which was specifically stressed in the resolution creating the special Senatorial committee. From both these viewpoints the committee takes a somewhat pessimistic attitude as to the ability of the United States to continue meeting requirements from resources presently available.

Admitting the possibility that any future war might be fought with weapons quite different from those used heretofore and that oil might play a less predominant part in the outcome, the committee wisely observes that this cannot safely be assumed. It makes the flat statement that in a war conducted on a large scale, it would not be possible to meet all military and essential civilian requirements from reserves now known within the United States.

As for oil belonging to American companies but located outside the United States, the committee points out that naval bases and tankers are subject to destruction, to say nothing of attacks upon foreign fields themselves. The answer, in the committee's opinion, is to be found in the development of a synthetic industry deriving products from the treatment of natural gas, shale and bituminous coal or lignites which will be capable of meeting all domestic requirements for centuries. To this end it recommends the continuation of research by government agencies and the building and operation of demonstration plants as already authorized by Congress on a limited scale.

As a measure of military preparedness it is obviously important to have accumulated reserves or at least reserve production capacity available to meet an emergency such as was thrust on the United States in December, 1941. Advance accumulation of supplies in storage is an unsatisfactory expedient. Means of effecting a prompt and sustained increase in production is essential. The recommendation put forward by the committee, however, seems thoroughly suited to this potential emergency situation, particularly as the higher cost of some synthetic products would be of small consequence when national security was menaced.

While it is eminently proper for the federal government, through its own agencies, to carry on the study of synthetic processes, it is to be noted that the oil industry of its own initiative is making constant progress in this field. The know-how of synthetic methods is possessed and has been applied in an experimental way by American oil companies. The production of gasoline from natural gas already is beyond the experimental stage. A plant for its commercial application is in process of erection and others are designed for early construction. Research departments on which individual oil companies spend hundreds of millions yearly are investigating other sources of synthetic supply, and certain companies are preparing for field operations. It is a perfectly safe prediction that before any military emergency threatening to national security is likely to arise, the oil industry will be prepared for it so far as oil resources can suffice.



The Abu Roash wildcat four miles from the pyramids drilled in 1946 by Standard Oil Co. of Egypt as part of an extensive exploratory campaign was recently completed as a dry hole at 6289 feet. A second well in this vicinity also was dry.

DRILLING ACTIVITIES EXPAND AROUND WORLD

REPORTS from companies in all parts of the international field indicate that 1947 will be marked by the most widespread activity in exploration and drilling of any year in the history of the oil industry. Activities that were interrupted by the outbreak of hostilities on both sides of the globe are being resumed. A start is being made toward repairing the damage inflicted by the war. Projects that have been held in abeyance for the past five years or more for lack of machinery and manpower are now being pushed forward. Even more compelling, perhaps, is the worldwide recognition of the economic value of oil and the consequent desire of governing authorities in every country to develop petroleum resources within their borders or at least to determine whether such resources exist. As a result, exploration is being extended to many areas not heretofore surveyed or investigated.

While delays in obtaining machinery and supplies still handicap operations to some extent, conditions in this respect are steadily improving. For a year past geophysical crews have been moving into near and distant lands as rapidly as they can be recruited and equipped.

As evidencing the broadened scope of exploration and development, South America provides a striking example. From Panama to Tierra del Fuego, the search for oil is being pushed in every country with the single exception of Uruguay, and even there tentative proposals for exploratory rights have been under discussion. In some of these countries, exploration is still in its preliminary stages, but from geological information already acquired, it is reasonably certain that important new fields will be discovered.

Venezuela remains the center of greatest activity and has strengthened its position far in the lead of all other countries in that part of the globe and second only to the United States among the world's oil producers. During 1946 its daily output rose to 1,100,000 barrels, and total production increased more than 20 percent over the preceding year, bringing it within striking distance of 400 million barrels, a figure that is likely to be passed during the current year.

Because of the urgent need for Allied military use of oil that could be most readily supplied from the Caribbean, special efforts were made to provide Venezuela with drilling machinery during the later stages of the war, and the country was thereby enabled to make an early start toward expanding its oil output. In the field of exploration also, there is a special incentive for Venezuelan oil companies to intensify surveying work. This is the time limit imposed by the law of 1943 on exploratory concessions before they are reduced 50 percent in area.

During 1946 a dozen companies drilled some 550 wells in Venezuela, of which 54 were wildcats. Major activities, both in development and exploration, centered in the states of Anzoategui and Monagas in the eastern half of the country where a number of discoveries and extensions of existing fields were reported. Extensive development drilling was carried on in the older western district around Lake Maracaibo where nearly 200 wells were put down. Although no new fields were uncovered in this area, exploratory tests under way at two points in the state of Zulia were reported as giving good indications.

As 1947 opened, 130 drilling rigs were in active operation in Venezuela, of which 90 were working in eastern districts and 40 in the west. Of the wells under way, 54 were classed as wildcats, indicating an appreciable increase in exploratory operations for the ensuing year as compared with 1946. At the same time over 60 geological and

geophysical crews were in the fields making surveys which will lead to future drilling tests.

In Colombia, although only a small increase in production took place during 1946 owing to a strike that interrupted operations in the early part of the year, two encouraging discoveries were made. One of these was at La Salina, a development of Socony-Vacuum Oil Company in the Mid-Magdalena Valley, southeast of Puerto Wilches where the first well completed produced 75 barrels daily. A second test is now being drilled. The other is in Teran where The Texas Company brought in Velasquez No. 1 as a producer. A second well is now being put down, and four others are scheduled for drilling during the year. Altogether 91 development wells were drilled in Colombia in 1946, of which 87 were completed before the end of the year. Of these 59 were in the De Mares concession of Tropical Oil Company, 15 in the Barco district of Colombian Petroleum Company and 17 in the Yondo concession of Shell where its Casable field is now producing at the rate of about 12,000 barrels daily. Nine wildcats were drilled during the year including the two discoveries mentioned.

In the Ilanos district of southeastern Colombia which has attracted much interest among oil men as an area of possible large production, two exploratory tests are now under way. One of these is Chaviva No. 1 of Tropical Oil Company, located in the territory of Meta near the eastern border. The other is Shell's San Martin No. 3. A noteworthy event during January of this year was the grant to Shell of a permit to explore the waters of the Continental Shelf off Pt. Colombia on the north coast.

At the present time some 45 wells are in process of drilling or are shortly to be spudded on sites that have been selected. Indications are that exploratory activities will show some increase over the past year. A factor that has hampered oil field development in Colombia has been the long delay in passing upon applications for concessions under the existing oil law. During 1946 only eight concessions were granted, while nearly two hundred applications are pending, some of which have been on file for several years. For the past five years successive proposals to simplify the terms of the law and make it more workable have been put forward, and the matter is now before Congress. A number of oil companies aside from those now holding concessions have had their representatives in Colombia during the past year and are interested in undertaking exploration.

Argentina, which with Venezuela and Colombia composes the triumvirate of large-scale South American producers, has had plans prepared for the past few years for the expansion of its oil industry. These plans have been held back until recently by inability to obtain needed materials; now that this obstacle is disappearing, they are being put into operation. An appropriation of $50,000,000 has been made for the purchase of equipment. A large part of this will be devoted to drilling machinery, since a primary objective is to make the country self-sustaining in the matter of petroleum and to avoid future shortages such as occurred during the war. A project now receiving special attention is the laying of a gas pipe line from Comodovo Redaviva to Buenos Aires.

Argentina's neighbor to the west, Chile, entered the ranks of oil producers at the end of 1945, when production was otbained from a test well drilled at Spring Hill on the island of Tierra del Fuego. This exploratory work has been extended with four wells drilled. Two more rotary rigs have been shipped to this area, one of which will be used in additional drilling at Spring Hill, while the other will be devoted to exploratory drilling in the San Sebastian area some 40 miles south of the original location. Chilean authorities are convinced that they have in prospect a field that under further development will be able to supply a substantial part of the nation's petroleum requirements.

First well to be put down within the borders of Paraguay is now being drilled near the western border of the Chaco district and is known as Santa Rosa 1. Meanwhile, the geophysical survey of the area is going forward under the agreement of Union Oil Company with the Paraguayan government, and arrangements are being completed for a second exploratory test. In neigh-

Tropical Oil Co. producing well on the La Cira structure, El Centro Colombia.

Arabian American Oil Co. wells are drilled two miles apart in the Abqaiq field. Thus far the field is not defined although 23,000 acres have been proven productive with known reserves now placed at 2.5 billion barrels.

boring Bolivia the projected expansion of existing production, which has been delayed by the change in the Bolivian government and by difficulty in obtaining drilling equipment, is shortly to be put into effect. This drilling program is part of a broad plan for development of Bolivia's oil resources which includes the enlargement of refining facilities and the construction of pipe lines. Press reports from La Paz have stated that a proposal is under consideration for an agreement between the government-controlled Yacimientos Fiscales Petroleos Bolivianos and a prominent company in the United States, by which the latter will participate in the development work by furnishing technical advice and assistance.

A South American country which is believed by many petroleum geologists to possess undeveloped resources far in excess of those which have been developed thus far is Peru. While Peru has been a substantial producer of oil for many years, its output has come from a relatively small area in proportion to its unexplored regions. In recent years the government has declined to grant exploratory concessions, but a revised oil law now awaiting Congressional approval would authorize the issuance of such permits to private companies. When such authorization is approved, a number of international companies will file applications covering the exploration of extensive tracts, particularly in the Montana region lying east of the Andes. An agreement extending permission to the International Petroleum Co., Ltd., to explore a large area in the Sechura desert in western Peru also is awaiting approval which is expected to be forthcoming at the approaching session of Congress. When such official action has been taken, a large-scale campaign of exploration will be put under way in Peru.

Topographically Ecuador presents conditions very similar to those in Peru, with development confined to its western section and a large unexplored region east of the Andes. Anglo-Ecuadorian Oil Company, Ltd., which is the largest producer in the country, has recently ordered four diesel drilling rigs to extend the development of its fields. International Ecuadorian Petroleum Co., Ltd., and the Shell organization, both of which have large concessionary holdings in the Montana region, are engaged in exploratory work. In this area Shell has drilled one well which ended as a dry hole.

For more than a decade the National Petroleum Council of Brazil, acting in behalf of the government, has been conducting drilling operations in Bahia, as a result of which three fields have been developed with a combined production of some 2,000 barrels daily. During the past few months, however, much more prolific production has been developed in the Candeias field where two wells have been brought in with an average output of roundly a thousand barrels per day. Encouraged by this discovery, enlarged activities are projected in this part of Brazil, and in view of the large areas regarded as potentially oil-bearing, consideration is being given to modifications of the petroleum law, permitting private companies to engage in exploration, a change which, if adopted, will attract large investment of outside capital and greatly increase field activity.

In Panama a concession has been granted to Sinclair Panama Oil Company, and preliminary surveys are expected to be followed by spudding of the first test well in the near future.

Thus, in every part of South America the search for oil in new areas and the development of established fields are proceeding at an accelerated rate in programs that will require several years for their completion and will call for very large expenditures and a tremendous amount of equipment.

In other American countries, particularly those surrounding the Caribbean, steps looking to initial exploration or to expanded production are being taken. The program for intensified activity adopted in Mexico is described on other pages of this issue. In Nicaragua the exploratory work begun before the war is being resumed on a larger scale, while concessions in other Central American states are being negotiated. Companies operating in Trinidad where war demands caused

Special portable rig recently built by Franks Manufacturing Co. for development and remedial work in French gas field.

fields to be produced beyond their maximum efficient rate are seeking to offset a threatened decline in output by the extension of drilling to new areas. Trinidad Leasehold, Ltd., has been conducting geophysical surveys in the Barrackpore district and at Guaguayare. One productive well has been drilled in the former area, and two tests in the latter have resulted in dry holes. In conjunction with United British Oilfields and D'Arcy Exploration Company, the company has acquired exploration rights over a marine area of 180,000 acres off the southwest coast of the island. Following a geophysical survey, a test well is to be drilled off Pt. Fortin.

Oil companies in Canada are intensifying exploration in the western provinces in the effort to offset the declining output of Turner Valley, and if possible to enlarge the proportion of the country's requirements supplied by indigenous production which is now only a little over 10 percent. At the present time some 15 companies, large and small, are actively engaged in surveys and test drilling in Alberta and Saskatchewan. An encouraging development was the bringing in of Imperial Oil, Ltd.'s Imperial Leduc No. 1 on February 4. This well is located 16 miles south of Edmonton. At 5,066 feet in Devonian, showings were so favorable that casing was set and a test was run under which the well flowed 40 barrels per hour. Hopes are expressed that this may be the forerunner of a fairly productive field.

Europe's oil industry, badly disorganized by the war, is now beginning the restoration of its fields and other facilities. Poland, for example, having lost 80 percent of its former production and much of its equipment to Russia, has set up a three-year drilling plan in an effort to find more oil in the west. The plan calls for 40 to 50 wells per year. Several light and medium rigs have been purchased but additional equipment is needed.

The Soviet Union suffered a severe setback in production as a result of the German invasion and inability to maintain normal development during the war. It has put under way a broad program intended to raise its annual output to the level necessary to support its ambitious plans for industrial expansion. Increased drilling is under way in the fields acquired from Poland and at many other places, including the district known as the Second Baku, around the Caspian, in the Ukhta region in the north and at several points in its Asiatic territories. Large orders for drilling rigs have been placed in the United States, and additional purchases are being made. Several hundred wells are said to have been brought into production, and the campaign is to be intensified as rapidly as possible with an annual outturn of 450 million barrels set as the goal to be reached by 1960.

Romania's urgent need of drilling machinery to prevent a further decline in production has had to remain unsatisfied because of the unfavorable exchange situation which makes imports from abroad difficult. With exports diverted from their usual channels and largely absorbed by reparations payments to Russia, conditions have had little chance to improve. If arrangements can be worked out wihch will enable the companies to operate on a reasonable basis, extensive new drilling operations will be undertaken.

Having lost control of Albanian oil and with coal imports reduced to a low point, Italy is in dire straights for fuel. The situation has aroused interest in renewing the search for indigenous oil supplies. Sometime ago an agreement was made with an American company to undertake exploration in Sicily. International companies that have interests in Italy have indicated their willingness to extend the search for oil to areas in the Po valley and elsewhere that are believed to contain some promise of production.

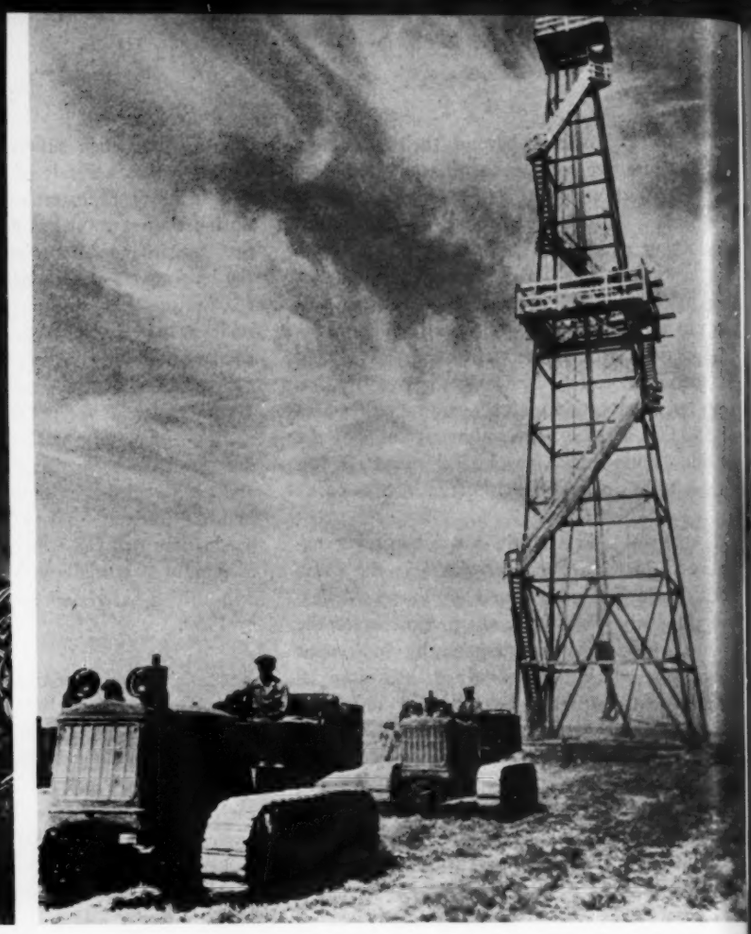
Hungary and Czeckoslovakia both have plans under way for the enlargement of their production under direction of their respective governments. From Hungary discovery of one small local field was reported recently. In Czeckoslovakia an appropriation of 20 million crowns ($400,000) has been made for exploration in western Slovakia and Moravia. A small new field has been reported near Brecklas on the Austrian border. Being occupied territory, little change has taken place in Austria itself. In Germany, where most of the wells are located in the British zone, production is continuing at about the prewar level but is insufficient for internal needs. The drilling rigs remaining are out of date and in poor condition. To increase output to the point of covering minimum requirements additional drilling will be undertaken whenever necessary equipment can be made available.

In some of the European countries that have had little or no production in the past, efforts are under way to locate new supplies. In Great Britain where a small but very useful field was developed during the war, additional prospecting licenses have been taken out by Anglo-Iranian and Anglo-American interests. Operating through its subsidiary, D'Arcy Exploration Company, Ltd., the former has obtained permits covering several areas in the Midlands, in the south of England and one in Scotland. Test drilling will begin as soon as surveys are completed. France, too, is putting new effort behind exploratory work in the south where gas wells and a small oil production were brought in just before the start of the war. Three companies are operating in this region, using American equipment and some American drillers. Some fifteen wildcats are in various stages of progression.

Danish American Prospecting Company, a subsidiary of Gulf Oil Corporation, has undertaken

Burning out a pit in the Abqaiq field of Saudi Arabia. Arabian American Oil Co. photo By Robert Yarnall Richie.

Wildcat at Barahona, Dominican Republic, drilled by Cia. Seaboard Dominica de Petroleo. Caterpillar Tractor photo.



Russians skidding a rig in the Kazakhstan field which is now estimated to contain 19 per cent of U.S.S.R. reserves. Sovfoto photograph.

a comprehensive exploration of Denmark under a program that calls for survey and test drilling in Jutland and on a number of Danish islands. Some remarkable salt domes have been penetrated in the course of the work, and as much as 150 feet of solid salt formation has been drilled. A heavy rotary rig has been shipped from the United States for use in continuing the work in Denmark. At the opposite corner of the continent, the Turkish government is continuing its search for oil which was interrupted by the war. Exploration is being carried on at Polatli near the Black Sea and in eastern Anatolia. Twelve portable rigs have been imported from the United States. In a well drilled at Romandaghi near the Syrian border, a yield of 30 barrels per day from 4,000 feet was reported recently.

Much attention has been directed to operations in the Middle East where large-scale activities both in exploration and development are scheduled. A projected expenditure of $70,000,000 over the next few years by Iraq Petroleum Company will include not only the laying of a new and larger pipe line to the Mediterranean which will triple the capacity of the existing line, but also contemplates additional drilling in the Kirkuk field to fill the larger line. Several of Iraq Company's satellite organizations, which hold concessions in various parts of southwestern Asia are engaged in exploratory drilling to test these holdings. Lebanon Petroleum Co., Ltd., is drilling a first test at Jebel Tarbol. Syria Petroleum Co., Ltd., has selected two sites for drilling in Syria. Petroleum Development (Palestine) Ltd., is preparing two locations in Palestine, at Gaza and Kornub. Petroleum Development (Qatar) Ltd. already has developed production at Qatar, and additional drilling will be undertaken as soon as transportation facilities for moving the oil can be established.

With nine wells, Kuwait is producing roundly 45,000 barrels daily. Seven heavy rotary rigs just recently have been shipped to this territory, and a doubling of output may be looked for within the next year or so, as the field is estimated to hold 10 billion barrels of reserves and the odds are strongly against any dry holes being turned in. In Saudi Arabia exploration and development are going forward with reenforcements of men and machinery from the United States. Present production of 200,000 barrels daily is expected to increase rapidly.

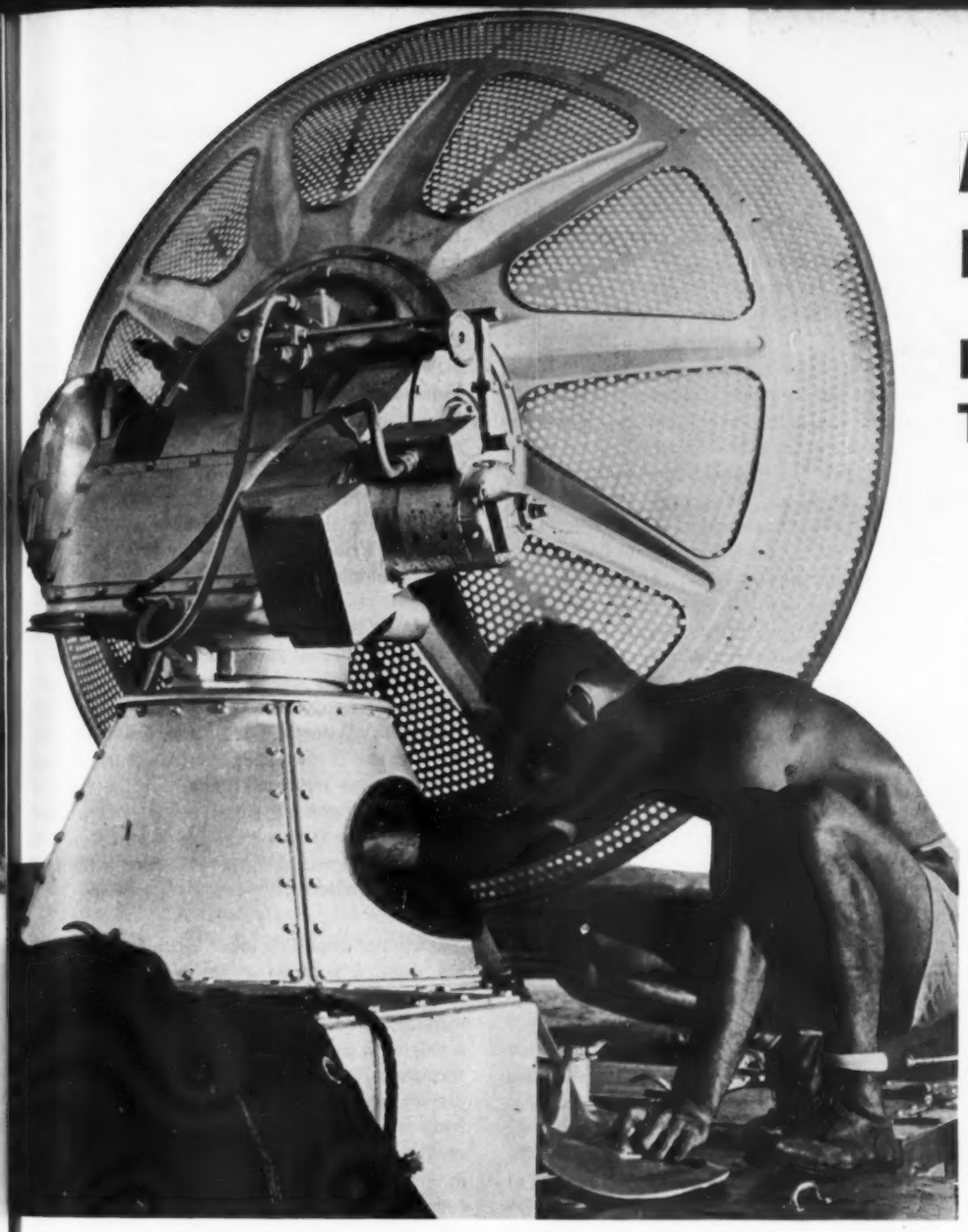
In the Sinai peninsula of Egypt, exploration is being carried on at several points through the joint efforts of Anglo-Egyptian Oilfields, Ltd. (Shell) and Socony-Vacuum Oil Co. A well producing 275 barrels daily was brought in on the east coast of the Gulf of Suez where geological tests indicate the presence of a fair-sized field. Standard Oil Co. of Egypt, a subsidiary of Jersey Standard, holds exploration permits covering six million acres of desert area. It has one diesel rig drilling in the southern part of the Sinai area and another further north. The company's holdings include a large area in the western desert where surveying parties are now at work. Further south in Africa, Sinclair Oil Corporation holds a blanket concession covering Ethiopia and has geophysical crews at work making surveys.

In the Fast East most of the activity of the past year has been directed to repairing damage inflicted on fields during the war or to preparations for the resumption of exploratory work interrupted by military operations. Restoration of fields in Borneo, Sumatra and Java is being carried forward by the Royal Dutch-Shell Group and Standard-Vacuum which are spending millions of dollars in this work. In western New Guinea, where prewar drilling resulted in one producing well, Royal Dutch-Shell is building piers and roads for the movement of machinery to be used in further drilling. In Papua the Australasian Petroleum Co., Ltd., a joint venture of Socony-Vacuum, Anglo-Iranian and Oil Search, Ltd., is carrying on exploration northwest of Port Moresby and is resuming the drilling of its test well at Kriave which was suspended at the time of the Japanese invasion.

Within the limits of this review it has been possible only to touch upon some of the principal activities in countries where oil search and developments are being carried on, and not even to mention some of the areas in which such operations are under way. It will serve, however, to indicate that these activities are worldwide and that 1947 will mark a new high point in the drive to bring into use more of the earth's oil.

MARINE EXPLORATION

DEVELOPS NEW TECHNIQUES



Checking the radar "dish" on a Humble Oil & Refining Co. geophysics boat operating in the Gulf of Mexico.

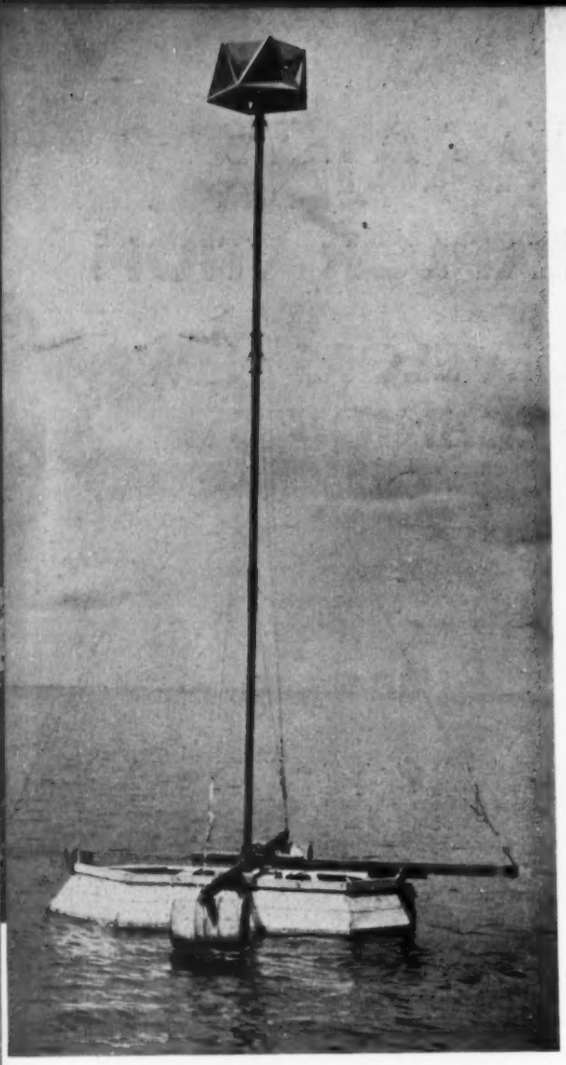
ONE of the noteworthy developments in exploration and drilling during the past year has been the beginning of systematic efforts to determine the presence of oil in submarine areas. Underwater drilling of course is no new thing. Mostly, however, it has been confined heretofore to operations conducted from land bases or to attempts to locate extensions of land fields already developed. On the Pacific Coast production has been obtained by directional drilling from shore locations or from piers built out over the water to support derrick structures. Along the Louisiana Gulf Coast submersible barges have been used extensively to provide drilling sites for wells 10,000 feet or more in depth. In other cases small islands or ledges, sometimes extended by dredging and filling, have provided a foothold for the work of drilling crews.

In the past few years several wells have been put down in the waters of Galveston Bay from foundations constructed of piling, and this work is continuing. One ambitious attempt to drill in the open waters of the Gulf of Mexico some years back was terminated when a hurricane wrecked the derrick that had been erected. In the Caspian Sea the Russians have been putting down wells in the shallow waters along the borders of the Sea in order to help maintain output in the Baku district. The most celebrated field of this type, however, is in Lake Maracaibo in Venezuela. With the development of the prolific fields that line the shores of the Lake, it was natural that attention should be directed to the waters of the Lake itself. The first wells were drilled from foundations built on wooden pilings near shore, but as these proved successful, operations were extended to deeper and more distant locations. In these deeper waters concrete piles are used and in recent operations caisson type foundations have been built up from depths of 130 feet or more.

As a result of the experience gained in these various types of operations, a great deal has been learned about underwater exploration. While they have been carried on mainly in regions more or less sheltered from destructive storms or within comparatively easy reach of solid ground, they have provided important information as to the structural requirements of foundations and the techniques of handling pipe, circulating material and other drilling equipment in restricted working spaces and under conditions where water communications must be depended upon for materials and supplies. Now the persistent seekers after oil are preparing to extend their earlier tentative steps offshore and to try their luck in the open seas, though wisely limiting their first attempts to shallow waters. The working out of efficient methods of survey offers fewer problems in such areas, while costs mount rapidly as greater depths are plumbed.

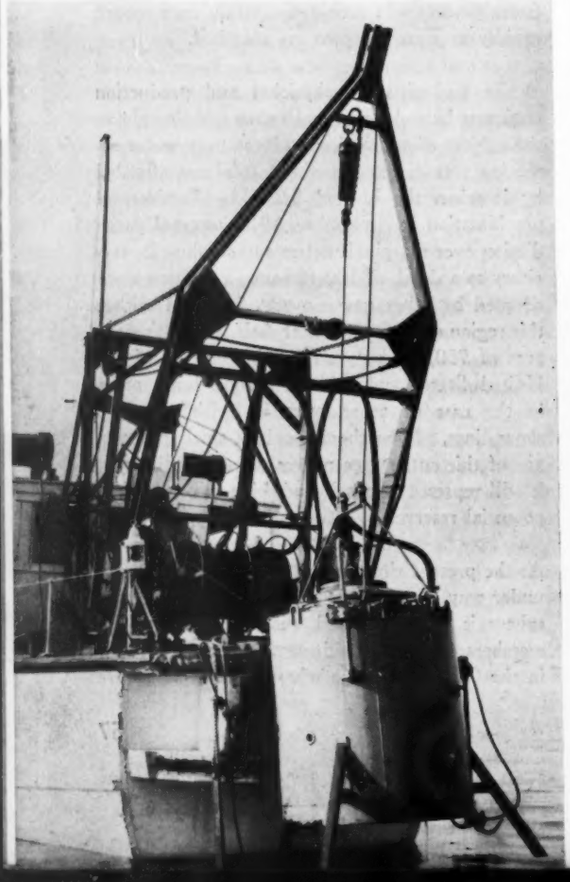
While geologists, geophysicists and production engineers have devoted much time and thought to the subject of submarine exploration, popular attention was directed to the possibilities afforded by it when the United States by Presidential proclamation in September, 1945, asserted jurisdiction over marginal waters surrounding its territory to a depth of 100 fathoms, a position since adopted by other governments. Included within this region of the continental shelf is an estimated area of 750,000 square miles in the case of the United States and correspondingly large areas in the case of other countries with extensive shore lines. Even though only a small percentage of this entire area proves to be petroliferous, it will represent a notable addition to the world's potential reserves.

At the present time submarine exploratory work under way in two regions in the Western Hemisphere is being watched with keen interest by members of the oil industry. One of these is in the Gulf of Mexico where several companies



Radar target used by marine geophysicists to locate positions exactly.

Diving chamber used by Standard Oil Co. (Bahamas) Ltd. for subsurface gravity meter observations.



have obtained concessions extending to 20 miles or more from shore. One well has been drilled to nearly 13,000 feet, and foundations are being constructed for other test drillings. In these wells drilling platforms are placed on top of timber and steel piles. Both the foundations and the derricks are strongly reinforced to withstand hurricane winds and battering waves.

Another scene of exploratory action which has more of an international character centers in the Bahamas, well out in the Atlantic east of Florida, where five large oil companies, three American and two British, hold concessions covering some 40,000 square miles, roughly one-tenth of which is made up of small islands, while the remainder consists of submerged sand banks, reefs and rock formations covered with water varying in depth from a few feet to six fathoms. In certain respects this region presents ideal conditions for underwater exploration, since it offers a very large area practically unbroken by heavy depressions. In other particulars it is less inviting as it is directly in the path of tropical hurricanes that now and again sweep from the Caribbean up the Atlantic Coast of the United States or out into mid-ocean. One company that made a study of weather records before filing its application found that over the past forty years there had not been one in which one or more storms of hurricane proportions had not made its appearance. The decision was not to attempt to avoid these manifestations but to build to meet them whenever the stage of drilling was reached.

The concession holders now carrying on surveys in the Bahamas include Standard Oil Co. (Bahamas) Ltd., a subsidiary of Standard Oil Co., (N. J.); Bahamian Exploration Co., Ltd., subsidiary of Gulf Oil Corporation; Bahamas Oil Co. Ltd., subsidiary of Superior Oil Company; Anglo Bahamian Oil Co., Ltd., subsidiary of Anglo-Iranian Oil Co., Ltd.; British Bahamas Oil Development Ltd., a combination formed by Trinidad Leaseholds, Ltd., and South African Mining Syndicate, and the Shell Oil group. Besides these there are two smaller interests, the Christie Syndicate and Bahamas Mining Co., Ltd., which thus far have not begun the development of their holdings.

First to begin exploration was Bahamas Oil Co., Ltd., which conducted a gravity meter survey on Andros Island, largest of the group, and also carried on some seismic work offshore. This company put down the first well to be drilled in the Bahamas which at last reports had reached a depth of between 10,000 and 11,000 feet. The well site is on Andros Island, so that its drilling cannot be classed strictly as a submarine operation, although the conditions surrounding it are much the same as though it were actually offshore.

Standard Oil Co. (Bahamas) for several months has been carrying on gravimetric and magnetometer surveys in waters covering part of its concession. As supply ship and living quarters for the men engaged in the work, the company has purchased from the Canadian Navy a roomy, shallow-draft vessel formerly used in anti-submarine service. Anglo Bahamian Oil Co., Ltd., has acquired a former British landing craft to serve a similar purpose.

A second chapter in the big task of surveying Bahamian waters is now opening. A contract concluded between the five large concession-holders and the Aero Service Company calls for a survey of the areas in which these companies are interested by use of the air-borne magnetometer—the "flying eye" as it is sometimes dubbed. This is one of several scientific developments worked out for use by the Navy in World War II by a number of cooperating companies.

Following the war the flying magnetometer was further developed and extensively tested as a means of rapidly mapping areas selected for mineral and oil surveys. It was tried out in the Adirondack Mountain region of northern New York where it completed in two months a survey that was estimated to require 25 years if made by a ground party using conventional means. Later it was employed by the Navy in mapping its great oil reserve in the wilderness of northern Alaska.

Though not displacing other instruments in making detailed surveys of prospective oil-bearing areas, the air-borne magnetometer has many advantages aside from its vastly superior speed in supplying a comprehensive picture of sub-surface formations. It provides a continuous record, permits the mechanical transcription of data from record chart to final contour map, reduces small anomalies to their proper proportions and in general presents information of greater accuracy than can be obtained with ground instruments. Its special adaptability to oversea surveys is obvious.

Other novel applications have marked the course of the surveys being made in this area. One of these is the use of radar to locate positions for gravimetric tests. Radar targets are set up on masts 25 to 50 feet high and reflections from these targets picked up by the screen aboard the equipment boat enable a whole series of positions to be located at exactly the points desired.

Another device employed where depths are such as to make it feasible is a diving chamber used in making gravimetric observations on the ocean floor. In the form adopted by the exploring parties of Standard Oil Co. (Bahamas), the chamber is a steel cylinder about six feet high and weighing about two tons. It has space for an operator and a gravity meter; it carries hose connections to provide air circulation, a telephone for communication with the surface and is well equipped with safety appliances. The chamber is raised and lowered by cable and winch from the stern of the service boat. Time

required for an observation is about twelve to fifteen minutes. The cylinder is designed for use in water up to ten fathoms in depth.

Another type of diving bell has been designed for use by one of the other companies engaged in Bahamian exploration. It is somewhat simpler, and lighter than the chamber used by Standard's group, is conical in shape and has but a single compartment. It is intended for use in relatively shallow waters.

A labor-saving plan worked out by some of the men engaged in gravimetric surveys mounts the gravimeter on tripods which are provided with wooden shoes. After each reading the equipment can be towed to its next location, the shoes causing it to ride the water and dispensing with the necessity of disassembling and remounting the apparatus at each change of position.

An ingenious plan that originated in England and is to be tried out by one of the concessionaires is a craft described by oil men as a spudded barge. It is equipped with supports referred to as feet and is so arranged that when it reaches a selected location, it can be raised above the surface and can be used as a workshop, operating headquarters or perhaps even for test drilling. Because of the extreme shallowness of the waters that have to be traversed, a variety of small craft have been designed for the use of working parties, some of them with a draught of as little as six inches. In the vernacular of the oil men, these light boats can go wherever there is a heavy dew.

While the attention of operating men interested in marine exploration has been confined mainly to meeting the conditions presented by shallow areas where the depth of water is not more than ten to fifteen fathoms, thought is being directed by others to possible future developments that may extend exploration to much greater depths. During the war military authorities experimented with the idea of drilling from a floating platform, the chief problem being to provide the needed stability for the platform to permit the operation of the drilling equipment. The results of these experiments were not published, but Prof. R. D. Sheewsbury, attacking this problem from the opposite end, so to speak, has worked out plans which he believes would provide a means of carrying drilling to ocean depths of a thousand feet or more. His proposal contemplates the handling of drilling work from chambers within a hollow steel column, divided into compartments and anchored to a concrete piling or foundation embedded in the ocean floor. The column would be supported by its own buoyancy, controlled if necessary by ballast tanks.

Inside the hollow stem would be working quarters with provision for rotary tables, mud pumps, pressure equipment and space for the racking of drill pipe. Since all working equipment would be in chambers far below the surface, the maintenance of stability would present no particular difficulty, as wave action does not extend more than thirty to forty feet below the surface. The superstructure of the column would extend above the surface to provide access for men and materials and quarters for the crew. Many other details have been carefully worked out to make the well drilling column invulnerable to the hazards of the sea. While this particular mechanism may never be employed in undersea drilling, it is safe to say that if the more immediate efforts to locate submarine oil fields prove successful, human ingenuity will find ways to carry the drill to still greater ocean depths. The industry has long been noted for its ability to overcome obstacles.

Drilling well in Galveston Bay.

Marine seismograph work is a daytime job. Humble Oil & Refining Co. boats tied up in a quiet Gulf coast cove for the night.

MAGNOLIA TESTING OFFSHORE FORMATIONS IN THE GULF

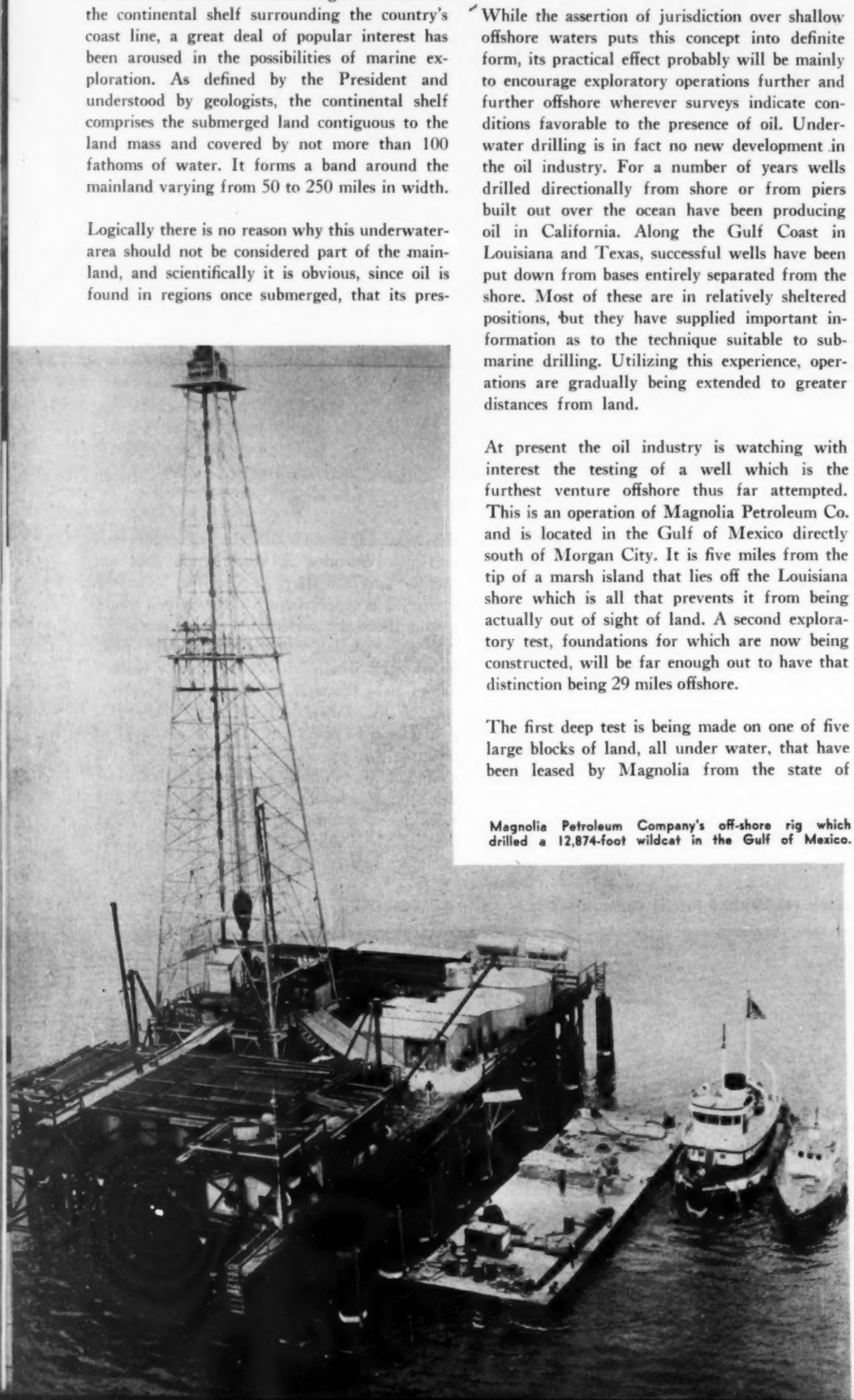
SINCE the proclamation by President Truman in September, 1945, laying claim for the United States to oil that might be found in the continental shelf surrounding the country's coast line, a great deal of popular interest has been aroused in the possibilities of marine exploration. As defined by the President and understood by geologists, the continental shelf comprises the submerged land contiguous to the land mass and covered by not more than 100 fathoms of water. It forms a band around the mainland varying from 50 to 250 miles in width.

Logically there is no reason why this underwater-area should not be considered part of the mainland, and scientifically it is obvious, since oil is found in regions once submerged, that its presence does not end at the shore line which some accident of nature has established today.

While the assertion of jurisdiction over shallow offshore waters puts this concept into definite form, its practical effect probably will be mainly to encourage exploratory operations further and further offshore wherever surveys indicate conditions favorable to the presence of oil. Underwater drilling is in fact no new development in the oil industry. For a number of years wells drilled directionally from shore or from piers built out over the ocean have been producing oil in California. Along the Gulf Coast in Louisiana and Texas, successful wells have been put down from bases entirely separated from the shore. Most of these are in relatively sheltered positions, but they have supplied important information as to the technique suitable to submarine drilling. Utilizing this experience, operations are gradually being extended to greater distances from land.

At present the oil industry is watching with interest the testing of a well which is the furthest venture offshore thus far attempted. This is an operation of Magnolia Petroleum Co. and is located in the Gulf of Mexico directly south of Morgan City. It is five miles from the tip of a marsh island that lies off the Louisiana shore which is all that prevents it from being actually out of sight of land. A second exploratory test, foundations for which are now being constructed, will be far enough out to have that distinction being 29 miles offshore.

The first deep test is being made on one of five large blocks of land, all under water, that have been leased by Magnolia from the state of Louisiana. When the land was offered by the state for leasing under the provision of a law whereby the state claims jurisdiction over the Gulf for 27 nautical miles out, Magnolia leased many thousands of acres of land under water at a cost of several hundred thousands of dollars. In addition it has obligated itself for payments totaling several hundred thousands of dollars more for rental before drilling begins. Aside from the income already assured to the state from the leases by Magnolia and the other oil companies now operating in this area, the people of Louisiana are watching with keen interest the progress of explorations in the hope that they will result in the discovery of fields that will add greatly to the state's revenues under the provision of the leases, by which it is to receive 12½ percent of all oil taken from the properties.



Magnolia Petroleum Company's off-shore rig which drilled a 12,874-foot wildcat in the Gulf of Mexico.

The first test is being made at a point in Atchafalya Bay, part of the Gulf, which lies approximately 34 miles south of Morgan City. It is 10 miles from Eugene Island Lighthouse and five miles from the nearest land, Point au Fer, the tip of a marsh island that forms part of the boundary of the bay. Eugene Island is part of a shell reef, a few hundred feet long and less than one hundred feet wide. It seems to be formed of oyster shells and probably is. It is low and supports sparse and discouraged vegetation. Until work began on Magnolia's project, there was nothing to distinguish it from hundreds of other such reefs in the Gulf except the government's lighthouse. Morgan City is built on what, in this part of Louisiana, is about the southernmost "hard land." South of the city to the shore of the Gulf lie thousands of acres of forbidding marshland—cross cut with bayous. Trappers peneterate the marsh with the aid of their pirogues, and where the little boats won't carry them, they do "marsh walking" with an uncanny skill that enables them rarely to step where hip boots won't protect them. Where oil prospectors work, high automobiles with broad tires, the "marsh buggies," rival the marsh walkers. In the marshes are oil fields of importance, and trappers who work in the marshes obtain a large part of the pelts that give Louisiana the distinction of being the nation's largest producer of furs.

The location for the first deep test was determined after a seismic exploration of the general area by Magnolia's geophysical department under the direction of Henry Cortez, Paul Nash and Jack Lester. The original field crew that carried on this work is now analyzing the balance of the underseas property and finding suitable locations for subsequent wells that will be needed in the work of proving the property. In the solution of many problems that have arisen in relation to the project, some details of which are unprecedented, the company has had the cooperation of the Louisiana State Mineral Board and the state Wild Life and Fisheries Department.

Focal point on shore for the present development

of the property is Morgan City, about 20 miles up the broad and deep Atchafalya River. From this port, famed as the center of Louisiana's thriving shrimp industry, all supplies needed for the project are moved by boat. The first step, after the location for the first deep test was determined, was to provide living quarters for the men on the job. It takes 26 men to operate the well-drilling equipment, but there are more men ashore or afloat than on the rig. As a matter of fact, 64 men are constantly at work on the project in addition to the 17 men who carry on seismic explorations. Living quarters are provided on an erstwhile Mississippi River steamboat from which the power plant had been removed. This craft, dubbed "Magnolia Inn" by its guests, is properly called the quarterboat. It provides comfortable sleeping quarters for more than 50 men. There is a large galley with a culinary crew that is exerting its best efforts to make "Magnolia Inn" famous for its cuisine! The men on the project need good food and lots of it, and the cooks see that they get it. There is a dining room and a recreation room. The quarterboat is moored alongside Eugene Island where wharfs were built for the accommodation of other boats of the project's fleet.

The rig itself is about 10 miles from the quarterboat. There is a sub-structure supporting the platform on which the derrick stands. The construction was designed and supervised by Magnolia's civil engineering department under the direction of E. E. Holstein, R. G. Watts and W. L. Montgomery, and their work has resulted in a man-made island of impressive strength. The support for the derrick took two months to build. The foundation required 338 wooden pilings, each 110 feet long and 16 inches in diameter at the butt. The steel derrick is given additional support by 52 steel pillars, each 136 feet long and 15 inches in diameter. The timber piling is strengthened further by a network of steel bracing, and timber caps are joined to the piling by metal hoods, providing a high degree of stability and resistance to the action of winds or waves. The floor level of the platform, which is 200 feet square, is 20 feet above the water A special feature of the derrick foundation was the provision for drilling three wells from the one foundation by skidding the derrick substructure forward or backward to two other positions. This was made possible by the use of a special design which transferred all derrick floor loads to corner and side columns of the substructure. Total loading of the timber platform deck was 200 tons, live load. The main platform deck was built for 500 pounds per square foot live load except under heavy equipment where the design was stepped up to 1,300 pounds.

The structure and the rig are exceptionally strong. In this location the greatest risk to be apprehended is from the hurricanes that sometimes sweep across the Gulf bringing high winds. The lateral stability of the drilling and derrick foundations were designed for a 150 mile per hour hurricane wind and resulting wave action.

Eugene Island, 10 miles from the well where the crew's quarterboat was moored.

The derrick itself was designed for a wind of 125 miles per hour. Hurricanes usually do not exceed 80 miles per hour and only rarely 100 miles per hour.

The 136-foot derrick has a 30-foot base. It weighs 48,000 pounds and is capable of handling a load of 800,000 pounds. Three 6-cylinder Cummins Diesel engines are employed in operating the draw works and another is used to operate the mud pumps. Specially prepared drilling muds were used.

No special measures were taken in running drill pipe and no unusual problems were encountered in drilling to the well's maximum depth of 12,874 feet which was reached on January 20, 1947. Greatest problem in the operation was the transportation of equipment from shore to rig in the early days of the project. As this is written (March 4, 1947) the well is drilling directionally at 10,601 feet from a whipstock set at 10,542 feet. Shows of gas were encountered at around 500 feet and at 1,500 feet.

At the rig, well samples are collected from the mud returns every 30 feet, and an electric log is run every 300 feet with sidewall cores being taken every 500 feet in likely appearing sands. Paleontological determinations and electric log correlations are made with other wells for comparative purposes. This work is conducted under the supervision of W. W. Clawson, P. H. Jennings and W. W. Canada of the Magnolia geological department.

The well is being drilled under the direction of Magnolia's producing division headed by E. D. Smith, manager, and A. E. Chester, assistant manager. M. V. C. Bradley is general production superintendent, and close to the job are Division Superintendent John Goodrich, Drilling Superintendent Albert Shaw and District Superintendent W. B. Powers. The 25 men in the drilling crew are under the supervision of I. L. Ault, drilling tools foreman.

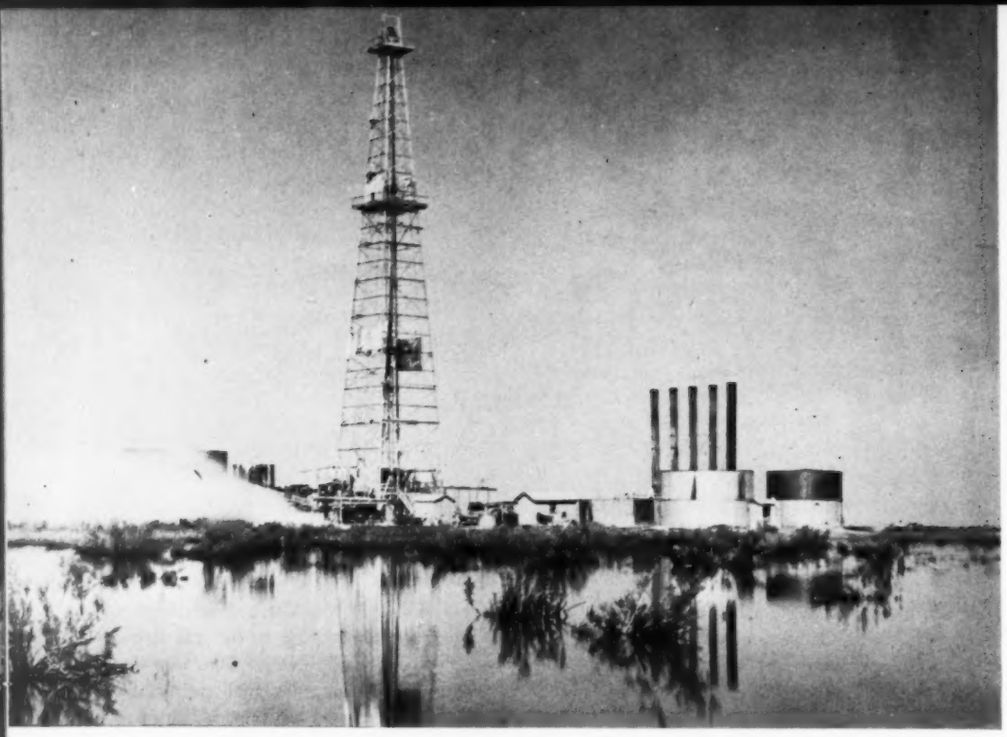
Generally favorable conditions have attended the drilling of the well through its early stages. Rough weather in the bay has isolated the rig only once. Then it was deemed advisable to transfer the men from the rig to the quarterboat until the blow subsided. No damage was done to the rig by the storm, but that the decision to remove the crew was wise is indicated by the fact that during the night the vessel employed in driving piling for the foundation of the second deep test broke from its mooring. It was found several days later 350 miles miles to the south.

Communications require considerable equipment and a large organization. A number of vessels have been hired for the transportation of material, and several more are owned and operated by the company. These include the new 105-foot cargo vessel, D. A. Little, which serves to transport material and may be used also for towing. It is named in honor of D. A. Little who retired recently from the presidency of Magnolia. Two smaller vessels honor F. V. Faulkner and M. J. McLaughlin, former managers of Magnolia's production department. Two fast crew boats are kept for continuous transportation service between the rig and the quarterboat. Other vessels are used for special purposes and emergencies.

Radio serves an important part in the maintenance of communications between various points on the project. Radiophone transmitters and receivers are on two automobiles ashore, on two crew boats, on the quarterboat and on the rig. By combination with landlines, communication may be established with the Dallas office of Magnolia. The seismograph field crews have a separate radio communication system between their boats and the Morgan City offices. Weather reports are important and are received at frequent intervals from shore stations and from the U. S. Coast Guard.

The whole communications system is under the direction of C. M. Rhodes, marine foreman who came to Magnolia from service as a submarine officer during the war. His organization consists of 28 men, including boat personnel, radio technicians and cooks.

(Continued on page 110)



Pacific Western Oil Corporation's recent deep test dr illed to 16,668 feet, a new world's record at that time.

PETROLEUM TRENDS IN CALIFORNIA

EXTENSIVE wildcat drilling in California resulted during 1946 in the discovery of many new pools and five new oil fields. These discoveries do not promise to add greatly to the potential producing capacity of the state, but they do balance the potential new reserves with the depletions of old fields. This condition has existed in California throughout the 1940's.

The East Los Angeles field, discovered by the Richfield Oil Corporation early in 1946, gives promise of being one of the larger potential fields with over 21,000 barrels production in 1946. The Alondra field near the city of Gardena has been a trial to drilling companies due to the spotty nature of the structure. Alondra was discovered by The Texas Company and British American Oil Producing Company when Bodger No. 1 was completed for initial daily production of 1,165 barrels at a depth of 9,153 feet. Standard Oil Company of California drilled a deep test on the Middle Dome of Kettleman Hills in 1946 and completed the well early in 1947. This field has not been officially credited as a new discovery, but the early reports are very encouraging and lead to hopes of greatly expanded production at Kettleman Hills.

Standard of California also has the credit of discovering the Leffingwell field between Santa Fe Springs and the Coyote oil fields. This well, drilled to a depth of 12,184 feet, is producing from 6,913 feet. General Petroleum Corporation brought in a producing well, after many difficulties, to discover the La Mirada field. The formation is most difficult to drill and produce, but the discovery well came in for an initial production of over 500 barrels daily. The well was the deepest successful wildcat of 1946, producing from a depth of 12,527 feet, but the extent of the field is not known.

The other new fields discovered in California in 1946 are Jasmine, discovered by Pacific Oil and Gas Development Corporation, and North El Segundo discovered by the Six Companies. Neither of these fields has been developed sufficiently to prove its extent or potential productive capacity.

From these discoveries it may be seen that the majority of the new fields were located by major oil companies; many were found only after long search and numerous dry holes. In contrast to the five new fields, there were 14 new pool extensions and new zone discoveries. Many of these are credited to independent oil companies and smaller operators. One can expect this same pattern to carry on in future California discoveries. The bulk of the new deep fields probably will be discovered by the major oil companies, but there will be an ever larger number of shallow discoveries of pools and zones by smaller companies and individuals conducting extensive exploration work in the older fields. There is no question that many shallow zones were passed up while the rush for flush deep production was on. These zones may be the main source of added potential production for California until new methods of exploration work are perfected.

Cymric, discovered in 1945 by Independent Exploration Company, proved to be the most important discovery of that year. This San Joaquin valley field produced over 350,000 barrels of oil in 1946. Santiago, Race Track and Ant Hills, other 1945 San Joaquin Valley discoveries, added another 300,000 barrels, while Ramona in the Coastal area provided 70,000 barrels and East Los Angeles, in the Los Angeles Basin, followed with 20,000 barrels. These five fields were the important contributions from 1945 discoveries, supplying almost 750,000 barrels of the 315 million barrels total production for 1946.

Deep wildcat drilling was common in California in 1946. January, 1947, found the world's deepest well in California, just as the title had been there in January, 1946. As in 1946, California's record stood for a few months only before the title returned to the Mid-Continent.

Pacific Western Oil Corporation's National Royalties No. 1 was drilled to 16,688 feet to break the world depth record. One of the remarkable features of this well was its freedom from serious mechanical trouble prior to sticking the drill collars at the final depth. This was one of several deep tests being drilled in the San Joaquin valley at the time, any one of which might have been a record breaker. Belridge Oil Company was drilling below 14,000 feet at South Belridge as was Richfield Oil Corporation at Coles Levee. Shell Oil at Ten Sections, Standard Oil Company of California at Middle Dome and a joint effort of Seaboard Oil Company, Universal Consolidated and Mohawk Petroleum were all drilling below 12,000 feet. All these wells are within a 75-mile radius of the record-breaking well, and all were exploratory holes.

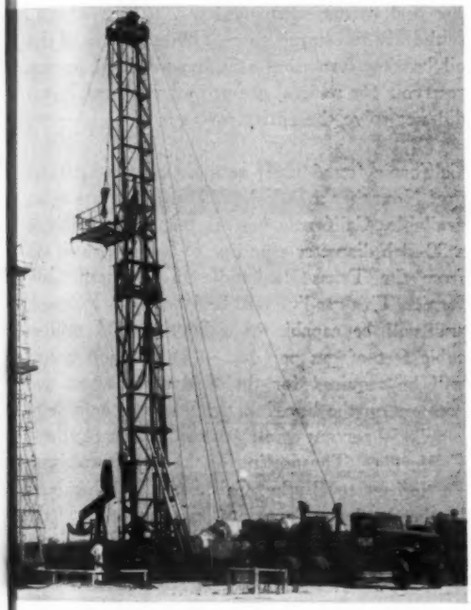
Other deep tests drilled in California included the C.C.M.O.'s Hobson C-11, bottomed at 14,155 feet at Rincon to become the deepest test in the Ventura area, and Shell Oil Company, Inc., Alamitos 48-A drilled to 14,950 feet to become the deepest test in the Los Angeles basin. C.C.M.O. also drilled a 12,930-foot deep test in the new East Los Angeles field, and Standard of California explored the old Santa Paula field to a depth of over 11,000 feet.

Standard's deep test at the Middle Dome has been reported to be a good well, and, if so, it may be the only one of the deep tests in California to prove successful. There are also many rumors of new oil zones found in the deep test drilled by Belridge Oil Company, but none of the reports have been confirmed.

Approximately 300 exploratory wells were drilled

in 1946, and they discovered five new fields and 14 new zones or pools. This is approximately the same number as were drilled in 1945, but the total cost of drilling was greater and the number of very deep tests was outstanding.

The conservation committee of California Oil Producers credits California with 1,342 new producing oil wells in 1946. This is a decline from the 1,707 producing wells completed in 1945 and 1,723 wells completed in 1944. The reduction in completions may continue as the old fields are being drilled to near their economic limit and the new fields are of limited extent. It has been estimated that 1,000 wells may be the number that should be expected from California in 1947. These wells would be drilled in those few old fields not drilled to their economic capacity and in shallow drilling of fields where zones of smaller production were passed up in an effort to reach flush production in deeper zones.



Deep well servicing equipment is being used by California drilling contractors in production and remedal work.

Shell Oil Co. drilled a deep test in the Los Angeles basin obtaining some production from a 14,000-foot zone.

The trend to combine efforts for the efficient development of a field has been demonstrated this year by the action of the Six Companies development of the new North El Segundo field. A 900-acre tract in the vicinity of the Los Angeles Municipal Airport is owned by Standard of California, Shell, Richfield, The Texas Company, Tide Water Associated Oil Company and the Union Oil Company. In order to develop this property, it is necessary to locate the wells at a distance from the airport right-of-way and directionally drill to the producing formation. These six major oil companies have agreed to a plan whereby the work can be done as a joint effort, and the wells can be drilled economically and in accordance with the airport restrictions. The joint operations eliminate the complications of surface land boundaries when selecting drilling sites and allow the drilling to proceed with a minimum of legal complications.

California produced approximately 315 million barrels of petroleum in 1946. This is a decrease of 11 million barrels from 1945 and an increase of five million barrels from 1944. One would be safe in saying that the past three years' production of petroleum has been fairly constant, and most of the fields are now operating at their efficient producing rate. With new discoveries approximately balancing withdrawals from proven fields, we can expect production to remain in the neighborhood of 310 million barrels per year. Any new major discoveries or new methods of increasing secondary recovery would of course alter that quantity.

The demand for petroleum products has rapidly increased on the Pacific Coast, and one can look forward to even greater demand with more and more new cars being delivered. The oil companies have been able to build up their stocks of gasoline and gasoline-bearing crudes in the past two years, despite the increased demands and constant production. The reduction in demands by the armed forces has helped build up this favorable balance, and the increase in both gasoline and gasoline-bearing crudes amounts to approximately three million barrels of each.

The oil companies would like a surface reserve of gasoline-bearing crudes equalling approximately 100 million barrels in contrast to the existing stock of approximately 25 million barrels. At an increase of but one to two million barrels yearly, there is no immediate danger of over-production, but neither is there danger of an immediate shortage.

The present demand on California petroleum is both local and off-shore. Several of the major California companies have instituted large foreign development programs which will reduce the demand for California crude and may even pave the way for importing foreign oil into California. This may sound like an undesirable procedure, but when one considers the vast drainage of local petroleum to fill military needs, this type of conservation is well worth considering. Shell Oil Company, Inc., has been working for several years to develop a substantial supply of oil in Western Canada, and some of the best California technical and practical men have gone to Canada for Shell to further this project. This development will make Canada more self-sufficient and also relieve some of the demand on California production.

Standard of California and The Texas Company have developed over 300,000 barrels daily production in Bahrein and Saudi Arabia alone. This Arabian production will fill much of the Near East demand filled from California before the war. The same two companies have formed the American Overseas Company to exploit petroleum in other sections of the world, and Standard of California is doing considerable development in South America under the name of Richmond Petroleum Company. It is very probable that Standard of California's South American oil will be shipped to California, while the company's California oil in fee-owned, drainage-protected fields may be conserved in place for future needs. Although no new major oil fields have been discovered in California in the past ten years, the future does not look too black. The days of easy oil appear to be over. The discoveries may continue to be small pools and new zones with but an occasional new field, but there does not seem to be any immediate need for alarm over a possible shortage.

Numerous secondary recovery programs have been in operation in California, but few of them have been of large magnitude or long duration. Many of the programs have been carried out as a conservation of gas rather than as secondary oil recovery programs and were discontinued as soon as the flush gas production disappeared.

The most interesting conservation programs in California continue to be the primary pressure control projects where an attempt is made to maintain initial formation pressures over extended periods. Many of the deep San Joaquin valley fields are being conserved by primary pressure maintenance programs. Large compressor plants are built soon after the fields are proven, and the surplus gas is reinjected into the formation from an early date.

The Temblor zone at Kettleman Hills is being re-pressured, and it is one of the more interesting of the actual secondary recovery projects in the state. Gas from the Temblor zone has been largely depleted, and approximately 100,000 million cubic feet of gas have been injected since 1935 in this secondary recovery program. The gas is cycled through the formation, and in the Kettleman project it absorbs the light fractions which are then recovered in surface absorption plants and the gas re-cycled.

Water drives are not as successful in California

as they are in the Mid-Continent because of the difference in formations. Union Oil Company, however, is conducting experiments with water drive in the old Richfield area with considerable success. Tide Water Associated Oil Company in the old Kern River field is reversing the usual system of water drive. This field is badly flooded with fresh water which channels through the oil-producing zone. Tide Water has found that it can use certain key wells as water removal wells and pump sufficient quantities of water to prevent this channelling and increase oil production.

Standard of California, in the Taft area, was confronted with a water disposal problem, and has utilized water drive, both to increase production from certain wells in the Greeley field and also to dispose of waste water. This program is still in an experimental stage, but it has been a means of disposing of waste water in an agricultural district where the disposal of salt water is a problem. The project also indicates that there is an increase in production from the well adjacent to the water injection wells.

Tide land ownership continues to be one of the most vital of California oil problems, and its solution is not predicted in the near future. The veto of the Congressional quitclaim bill in 1946 leads one to believe that the tide lands problem will become a long-drawn-out legal fight. Offshore drilling in California has progressed from the early days at Summerland, near Ventura, California, when this was one of the two places in the world where oil was obtained from under the ocean, to the present development at Wilmington, Huntington Beach, Rincon and Elwood.

Offshore drilling continues despite the question of title to the land but at a reduced rate. Most of the drilling is done from mainland locations by means of directional drilling, and the majority of the work is done with steam equipment. One new power rig is drilling in the Elwood field, and it has proved very successful. The rig is powered by three 300 H.P. engines which provide power for both rotary table and slush pumps. The directional drilling requires special rotary table drive ratio to produce slow rotating speeds and high torque encountered. A small power rig was also used in shallow wells drilled from the old piers at Rincon, and an electric rig was used in the same area.

The Marine Exploration Company planned to drill offshort from an artificial island near the city of Seal Beach, but these plans have been set aside due to the refusal of the city to grant a drilling permit. The future of offshore drilling awaits the settlement of the tidelands ownership suit, and one need not expect any developments other than in existing proven offshore fields until the suit is settled.

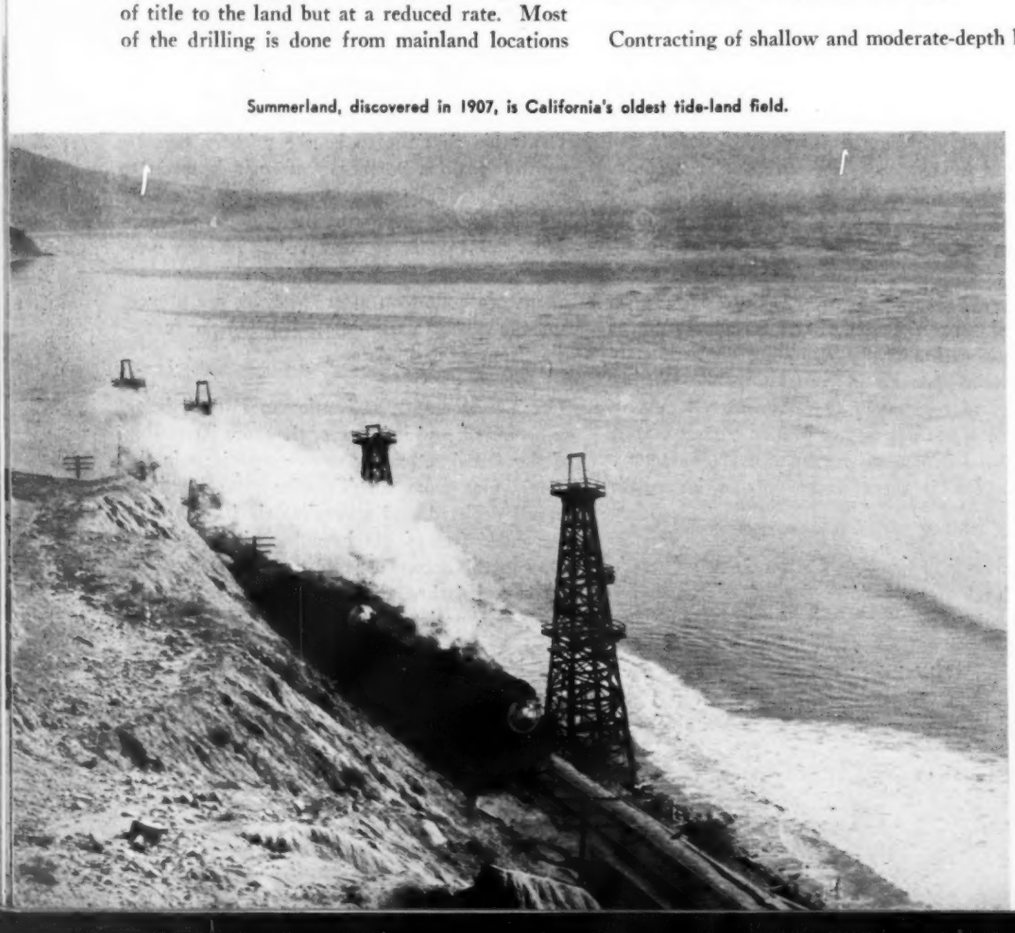
California has been one of the last strongholds of company drilling programs. 1946 saws this program weakened by the decision of two major companies to sell all of their drilling equipment and contract all their wells. Both Union Oil Company and Continental Oil Company sold all their drilling equipment to employees of the respective companies. The ex-employees set up their own drilling contracting organizations, and they are now active in that field. Several of the other major companies maintain a few drilling crews but contract all their surplus drilling. It is interesting to note that The Pacific Western Oil Company's record well was drilled by Loffland Brothers, contractors, and Rocky Mountain Drilling Company has contracted for California wells in excess of 14,000 feet in depth.

Contracting of shallow and moderate-depth holes is carried on in an ever-increasing scale, and a considerable amount of deep servicing and remedial work in the San Joaquin valley is now done by contractors. Special well servicing equipment with portable derricks and large capacity sand line drums have been developed for this work. The increase in contract drilling in California is one of the outstanding developments in the past three years especially in the deep drilling fields

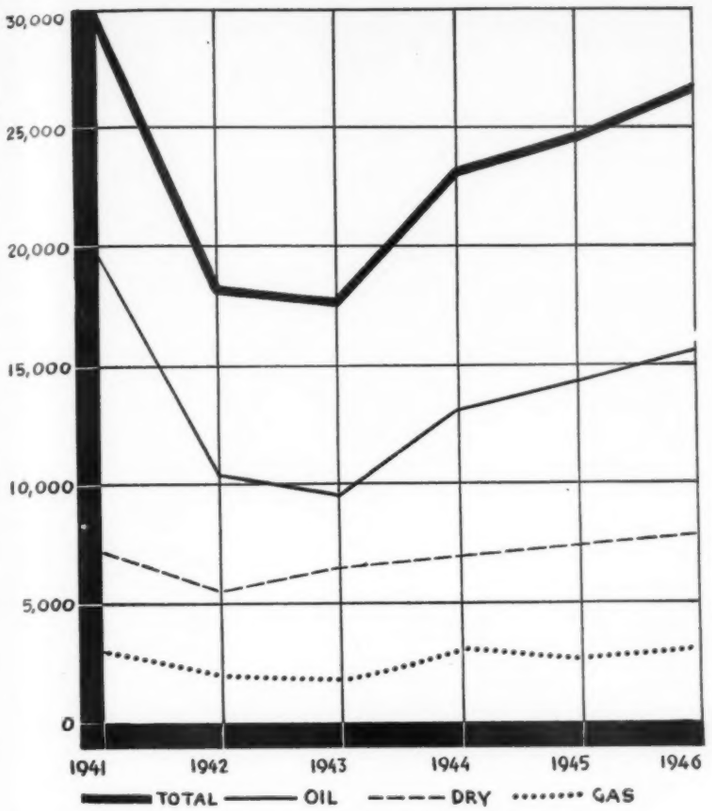
California's industrial expansion during the war increased the demands for natural gas to such an extent that some of the oil companies were required to burn oil under their boilers while they sold natural gas to the public utility companies. The Playa Del Rey Hills area was converted from an oil field to a gas storage field in order to provide immediate storage facilities for summer excess gas adjacent to Los Angeles. The gas was compressed and stored in the formation until the peak winter demands made it advisable to withdraw the stored gas. The operation of this oil bearing formation as a huge natural storage reservoir for natural gas proved practical, but it did not solve the entire problem.

California found itself actually short of natural gas! Now that material and manpower are again available, California has started construction of a 30-inch diameter pipe line to bring natural gas from the Texas Panhandle to Southern California. This gas line will be 1200 miles in length and will be capable of delivering 305 million cubic feet of gas per day. 141,000 horsepower will be required for the field compressors and boosters on the line, but the line will be able to supply 50 percent of all gas required in Southern California. The portion of the line from Santa Fe Springs to Blythe, California, is being built by the Southern Counties Gas Company and the Southern California Gas Company. The balance will be built by El Paso Natural Gas Company.

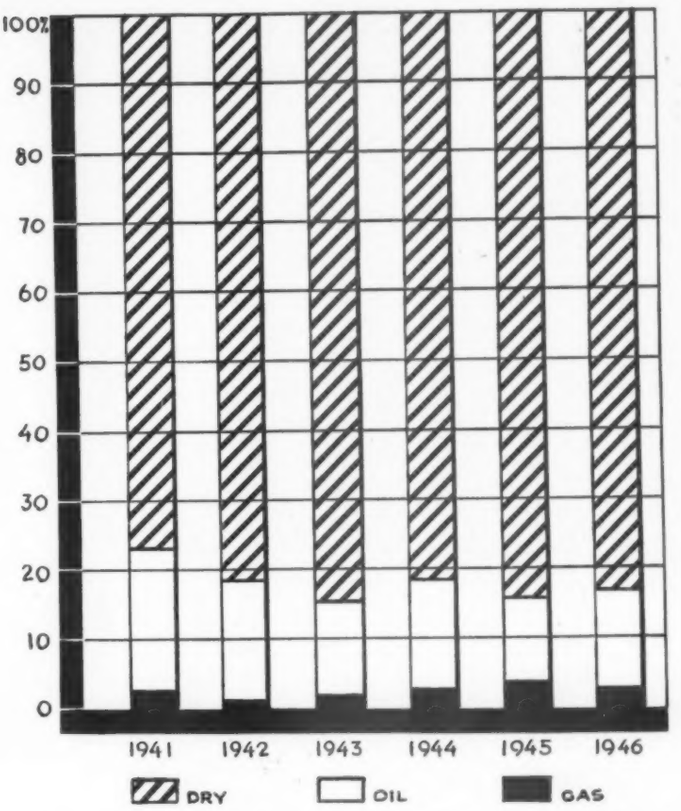
Summerland, discovered in 1907, is California's oldest tide-land field.



Richfield Oil Corp. used a sound-proof rig for this town-lot wildcat test.



Trend of drilling in the United States. Figures in thousands of barrels.



Success ratio of U.S. Wildcats. Figures are in percentages of all wildcats drilled.

1946 DISCOVERIES BALANCE PRODUCTION

BY drilling more wells than in any year since 1941, the oil industry was able to keep pace with consumption in 1946. There was not a significant surplus available for addition to reserves and stocks, however, as a result of the year's operations. The small addition to reserves was made possible because domestic demand for petroleum and its products showed virtually no increase over 1945, and the drop in exports resulted in a net decrease in total demand. In the first 11 months of 1946 domestic demand for oil averaged 4,843,000 barrels daily, an increase of only 3,000 barrels over the daily average for the same period in 1945. Total demand for all oils dropped 98,000 barrels to a daily average of 5,260,000 barrels in the 11-month period.

Enlarged refining activity elsewhere in the world cut into exports of U. S. oil products. Shipments of refined products abroad decreased 40.8 million barrels in the first 11 months of the year but, since crude exports increased 6.9 million barrels, the net loss in export volume was 33.9 million barrels, a drop of 19.6 percent. Imports of crude and products increased 25 million barrels, but the industry still retained a net favorable balance of exports over imports totaling 70 million barrels in the 11-month period for which Bureau of Mines figures are available at the moment.

Drilling operations in the United States were above 4,000 at the opening of the year but dropped almost to 3,000 in April. From that point there was a gradual increase until the close of the year when more than 4,000 rigs again were running. Completions of wells drilled for petroleum totaled 26,491 in the year, an increase of 7.4 percent over the record of 24,540 in 1945. Service wells drilled were virtually unchanged at 2,172.

Success ratio of all wells drilled was slightly better in 1946 than in 1945. Oil wells completed totaled 15,665 or 59 percent of all wells compared with 14,283 or 58 percent in 1945. Gas well completions increased 141 to 2,935 and dry holes 428 to 7,891. Nearly 30 percent of all wells drilled for petroleum (excluding service wells) were dry.

U. S. Wells Drilled for Petroleum

Year	Oil	Gas	Dry	Total
1946	15,665	2,935	7,891	26,491
1945	14,283	2,794	7,463	24,540
1944	13,028	3,067	7,009	23,104
1943	9,717	1,782	6,385	17,884
1942	10,492	2,068	5,504	18,064
1941	19,552	3,007	7,128	29,687

U. S. Wildcats Drilled

Year	Total	Oil	%	Gas	%	Dry	%
1946	4,433	606	13.6	119	2.7	3,708	83.7
1945	4,190	545	13.0	136	3.0	3,509	84.0
1944	4,324	633	14.7	117	2.7	3,574	82.6
1943	3,642	499	13.7	72	2.0	3,171	84.3
1942	3,166	466	14.7	57	1.8	2,643	82.2
1941	3,264	650	20.0	83	2.5	2,531	77.5

Wildcat drilling increased about in the same proportion as all wells. Completions totaled 4,433, an increase of 243 or six percent over 1945. Success ratio also was about the same. Of wildcats completed, 606 were oil wells, 119 gas and 3,708 dry. Dry hole percentage was 83.7 percent compared with 84 percent in 1945.

Wildcatting activity brought very poor results in the southeast and in California. There were no successful wildcats completed in the Carolinas, Georgia, Florida, Tennessee or Alabama, and Mississippi wildcatters found only two oil wells out of 79 tries. In California 95 percent of all wildcat wells drilled in 1946 were dry, and local West Coast demand ate into underground reserves.

Total domestic crude production of 1,730,000,000 barrels was slightly bettered by new discoveries and reappraisal of reserves in older fields. Known reserves of crude on December 31, 1946, were estimated at 21.0 billion barrels, compared with 20.8 billion barrels a year earlier.

MEXICO PUSHING PRODUCTION PROGRAM

Poza Rica plant silhouetted against flares of sour gas for which there is no current market.

ANNOUNCEMENT of the bringing in of a new well in Vera Cruz yielding oil at the rate of 2,500 barrels per day is looked upon as giving an auspicious start to the program of exploration and development projected by Petroleos Mexicanos for the current year. The well was drilled on the recommendation of Pemex geologists. It is located at Tlacolula, some 50 kilometers west of Cerro Azul in the state of Vera Cruz. From the extent of its initial flow, it is believed to mark the existence of a field of substantial extent. It is stated, moreover, that its oil is of high quality, superior in this respect to that of Poza Rica.

Under the energetic leadership of Gen. Antonio P. Bermudez, managing director of Petroleos Mexicanos, a vigorous campaign of exploration and development has been put under way. Drilling has started on seventeen wells in Vera Cruz, Tabasco and Tamaulipas, on the Gulf Coast, and in the Cuchillo Parado region in Chihuahua near the United States border. Preparations are being made for exploratory tests, proposed by company geologists, in the San Ignacio zone, Baja California. This area is at the juncture of the northern and southern districts of Baja California. The outcome of these tests will be watched with special interest. Pemex hopes that oil may be found in sufficient amount to meet the needs of Baja California. Because of its geographic location and lack of transport connection with domestic sources of production, this section has been mainly dependent upon the United States for oil.

Other exploratory drilling will be undertaken on the Isthmus of Tehauntepec in the effort to extend existing fields where production has been declining. Extension of the gas fields developed in northern Mexico southwest of the Texas border and increased production of natural gas also is being sought, and a half-dozen rigs are occupied in this work, which was intensified during the period when it seemed doubtful whether authority would be granted to increase the quantity of gas obtained from Texas fields. The ultimate object of development in this northern area is to make Mexico independent of importations. Altogether the program set up for the current year contemplates the drilling of between forty and fifty exploratory wells and for as much development drilling as available supplies of machinery and material will permit.

Assistance is being extended to the geological phase of Pemex activities by the geological department of the Ministry of Hydraulic Resources which has taken over operation of the National Irrigation Commission and has organized to make investigations of various kinds. This department is cooperating with the Institute of Geology of the University of Mexico and the petroleum division of the Ministry of National Economy.

Development work of the oil industry will be largely centered in the Poza Rica field which has been Mexico's most dependable source of oil supply since expropriation and which still provides more than half the country's crude output. Sites have been selected for a score of wells to be put down within the present field and a number of wildcats are to be drilled in outlying areas to test possible extensions of the field. In addition to this new drilling, work has been undertaken to put an end to wastes that have prevented the full utilization of existing resources. Improvements in the Poza Rica-Mexico City pipe line and the stoppage of leakages have resulted in substantial saving of crude, while installation of a system for treating wet gas has added to available supplies.

Following a recent inspection tour of oil fields and installations in the Gulf area, Gen. Bermu-

dez reported that he was very well pleased with the progress being made. Installations at Poza Rica and Azcapotzalco will give "stupendous results," he said, in the way of greater yields from crude and gas. The gas stabilization plant at Poza Rica is handling 80 million cubic feet of gas daily, recovering natural gasoline, propane and other products. The capacity of the Poza Rica-Azcapotzalco pipe line has been practically tripled, and it is now delivering 44,000 barrels of crude daily to the refinery, in comparison with 15,000 barrels formerly. Nine pumping stations have been put in operation on the line instead of the three with which it formerly was equipped. An improvement in the refinery is the installation of a hot water treatment to remove chlorate of sodium from the oil which increases its availability.

Extensive civic improvements for Poza Rica have been authorized by President Aleman. These will include works of sanitation, street paving, the building of homes for workers and establishment of recreation centers and playgrounds. These works will be carried out by the Ministry of Communications and Public Works at a cost of 1,800,000 pesos, toward which Pemex has contributed 435,000 pesos.

Increased production of oil and the distribution of its products in quantities sufficient to meet the needs of every part of the country is the primary objective of the Pemex management. In this connection the company emphatically denies reports that have been circulated in Mexico to the effect that the building of a refinery at Salamanca, Guanajuato, had been suspended for lack of funds. This refinery with connecting pipe lines was projected to improve the distribution of oil products to the north-central, western and northwestern sections of the country. While admitting that construction has been slowed down, company officials stated that this was due to delays in the delivery of materials and equipment from the United States. The refinery was one of the projects visited by Gen. Bermudez on his recent trip on which he was accompanied by Ing. Antonio M. Amor, technical director of production for Pemex, Paul Medina Mora, his private secretary, and Jorge Sabas Ricarde, press secretary. While the Salamanca refinery will incorporate in part equipment transferred from Meta Redonda, it will not be merely a duplication of that plant but will be much more modern and efficient. It will have a daily throughput of between 20,000 and 30,000 barrels. Work is soon to begin on the 450 kilometer pipe line from Poza Rica.

Director Bermudez has made known that Mexico is currently exporting oil to the extent of about a million barrels per month. He emphasizes that these exports represent surplus output after giving full attention to the needs of the domestic market. Shipments are going to the United States, Cuba, Italy, France and Belgium. Norway is taking certain quantities of asphaltic crudes. Limited amounts of gasoline are going to Central and South America, including Guatemala where Pemex maintains a sales agency. Most of the purchasers provide transportation for their takings by means of their own tankers. With rising production, a rise in the volume of exports is anticipated, as demand from abroad is "very strong."

Aside from the expansion of oil production and the distribution of oil products, there is great public interest in increased supplies of natural gas, a subject which is taking on growing importance in view of the number of new factories being erected and the general movement toward industrialization. It is known that Pemex has had under consideration for some time plans for a gas pipe line from the Gulf to the Mexican capital which, with a population of over 2,000,000 and a rapid expansion of its manufacturing activities, is a prime market for gas fuel. The statement of the Pemex chief regarding the large amount of gas available at Poza Rica is held to give substance to the expectation that definite announcement may soon be made in regard to the pipe line project.

Gen. Bermudez did say, on his return from his recent trip, that a larger natural gas supply for Monterrey and the industrial area surrounding the Nueva Leon capital would soon be assured. More wells are being drilled in the five gas fields of the northeastern states, and arrangements are being completed with Monterrey businessmen to build a gas pipe line from the fields at Mision, Tuamaulipas, to Roma where connection can be made with a line to Monterrey. Line length will be 52 kilometers.

The friendly but firm attitude toward labor announced by Sr. Bermudez when he took over the post of managing director of Pemex, and which reflected the position of President Aleman as stated in his inaugural address, appears to be bearing fruit. That the firmness was not merely a cloak was demonstrated some time ago by the disciplinary action taken in the case of local unions that persisted in a strike that had been pronounced illegal. The friendliness has been displayed throughout his conferences with union officials and in his talks to union members. His creed is simple. Production must be the keyword of the oil industry. Members of the industry must realize that wages and other charges can be paid only from earnings. Workers must give a fair return in labor for the wages they receive. Sustained effort leading to greater output is the only sound road by which to provide a higher standard of living.

Director Bermudez has expressed confidence that labor difficulties will soon be ended and that the spirit of cooperation he demands will be attained. He predicts success for the mixed committee under the chairmanship of Lic. Manuel Ramirez Vazquez, Subsecretary of Labor, that is studying the reorganization of the oil industry in an atmosphere that is described as one of "harmony and work." Representatives of Pemex on the committee are Antonio Manero, Lic. Praxedis Balboa and Lic. Francisco Avellano Belloc. The oil workers union is represented by David Robles, section one (north), Frederico Aznar, section 34 (center), and Cesar Ramirez, southern zone.

Another step toward peaceful relations is evidenced by the union's ousting of its entire executive committee and the election of new officers headed by Antonio Abrego, secretary general. Some criticism has come from laborite quarters that Pemex has not likewise appointed "new people" in order to "avoid antecedents that could be prejudicial." This complaint, however, is not regarded as of serious importance. An indication of oil labor unity was seen in the announcement that Section three (Ebano, San Luis Potosi) has formally disavowed the "divisionist tactics" of its delegates to the fourth labor convention and has endorsed Sr. Abrego and his executive committee.

General view of the Poza Rica field.

AUTOMOTIVE TRENDS

LIKELY TO AFFECT THE PETROLEUM INDUSTRY

By GEORGE H. SCHOENBAUM*

NO TWO American industries of comparable size are as dependent upon each other as the petroleum and automotive industries. Each must keep abreast of the other if progress is to be made in supplying the public the best transportation at the most reasonable cost. The closest co-operation between technologists of both industries is required to insure maximum progress with the least delay.

Since the resumption of production by the automotive industry in the fall of 1945, there have been relatively few production changes or announced developments by the automotive industry which are of interest or importance to the petroleum industry. The 1947 models which now are being introduced appear to be substantially the same as the 1946 models except for a minor changes in styling. Notwithstanding a continuation of the present "seller's market," it appears likely that some results of the research and development work conducted during and subseuent to the recent war will soon make their appearance. It is believed unlikely, however, that more than one or two manufacturers will offer significantly different passenger cars or engines during the current calendar year. The 1948 models of several manufacturers, now scheduled to make their appearance in January, 1948, are expected to embody some departures from current body and engine designs. Some of the anticipated changes will materially affect the oil industry.

Of equal importance to the petroleum industry are certain well-established trends which are expected to influence future designs. An attempt will be made here to review briefly the new developments and current trends expected to have the most significant effects upon the petroleum industry. The introduction of new developments is governed largely by economic factors. Within recent months, the plans of many manufacturers have been frequently changed and modified. More changes can be expected. All that is reported here should be considered with this fact in mind.

With but few exceptions, the 1947 models will be a continuation of the 1946 models with minor changes in styling intended to enhance re-sale value. Cancellation by General Motors of its tool and die program for 1948 Chevrolet—Oldsmobile—Pontiac "A" bodies at a loss of hundreds of thousands of dollars indicates renewed faith in the strength of the present "seller's market." Packard has announced that it will introduce in March 1947 an entirely new car "from the tires up." Only the convertible body style will be available at first.

A considerable difference of opinion exists as to the future of "light-weight" cars. One chief engineer thinks that the industry must build lighter, more efficient and more economical cars to fall within the means of more wage-earners. Others maintain that the public will pay for new and higher standards of luxury, quality and performance. Larger manufacturers are in a position to follow public demand in either direction. In any event, lighter-weight cars in appreciable quantities are not expected to appear before 1949 or 1950.

Passenger car engines are not expected to change appreciably in the near future with respect to weight and displacement. The decrease in displacement occurring between 1942 and 1946, shown in Figure 1, resulted from the discontinuance of several large engines and does not reflect a trend towards smaller engines. There is a revival of interest in the very large truck engines, and several manufacturers are expected to offer new 600 to 700 cu. in. engines in the near future. The trend in bus and truck engine displacement, shown in Figure 2, is expected to continue.

Carburetors and fuel systems are expected to remain substantially the same for the next several years. Present fuel injection systems, both direct and manifold, are considered too expensive to warrant adoption for passenger cars, trucks and busses. Some stationary and tractor engine manufacturers are investigating the manifold injection, and limited use in this field is expected. Induction systems and combustion chambers of both present and new engines are scheduled for considerable change to improve engine performance and reduce knocking tendencies.

Pressurized cooling systems, now used to a limited extent, are expected in many future vehicles. It is claimed that completely sealed cooling systems will allow quicker warm-up, help eliminate air pockets, permit the use of a smaller radiator, but may require slightly higher octane fuels. Styling is likely to determine the extent of use on future passenger cars. Crankcase ventilation and closer control of oil temperatures are receiving considerable attention with a view to eliminating, as far as possible, "cold temperature" types of sludge. Such improvements can be expected first in truck engines.

The use of sodium-cooled valves, valve inserts,

* *Engineering representative, Standard Oil Co. of New Jersey, Detroit, Mich.*

Figure 1. Design Trends of American Passenger Car Engines since 1925. (Courtesy of Ethyl Corp.)

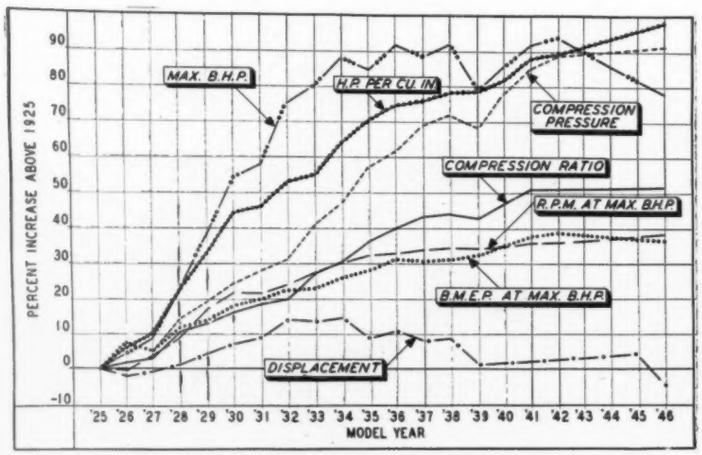
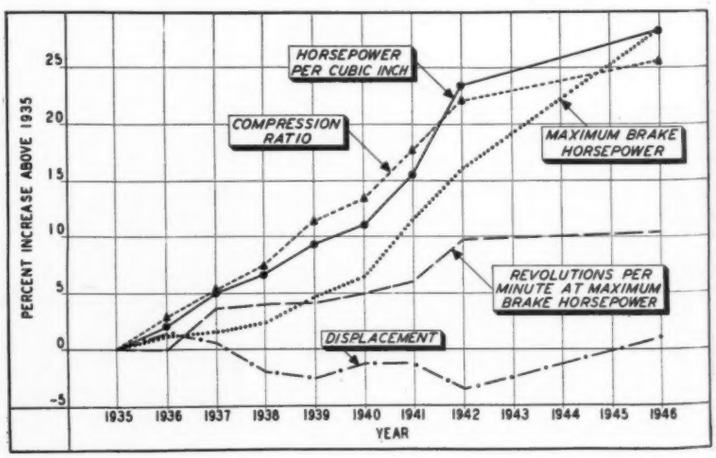

MAX. B.H.P.
H.P. PER CU. IN.
COMPRESSION PRESSURE
COMPRESSION RATIO
R.P.M. AT MAX. B.H.P.
B.M.E.P. AT MAX. B.H.P.
DISPLACEMENT
PERCENT INCREASE ABOVE 1925
MODEL YEAR
'25 '26 '27 '28 '29 '30 '31 '32 '33 '34 '35 '36 '37 '38 '39 '40 '41 '42 '43 '44 '45 '46

Figure 2. Design Trends of American Bus and Truck Engines since 1935. (Courtesy of Ethyl Corp.)


HORSEPOWER PER CUBIC INCH
COMPRESSION RATIO
MAXIMUM BRAKE HORSEPOWER
REVOLUTIONS PER MINUTE AT MAXIMUM BRAKE HORSEPOWER
DISPLACEMENT
PERCENT INCREASE ABOVE 1935
YEAR
1935 1936 1937 1938 1939 1940 1941 1942 1943 1944 1945 1946

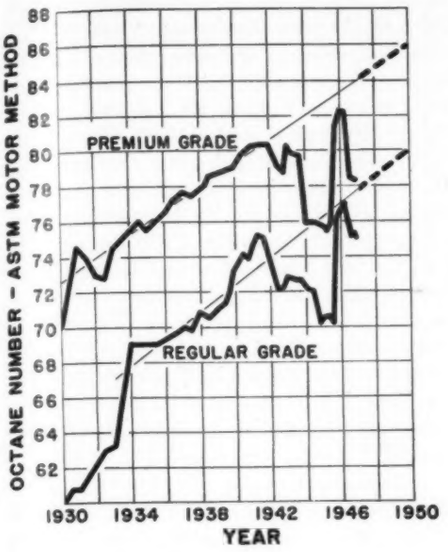


Figure 3. Octane Number Trends of Motor Fuels since 1930. (Courtesy of Ethyl Corp.)

various valve facing materials and rotators in truck and bus engines is expected to be extended. The flexible oil ring now used in one series of truck engines is reported to be highly successful in effecting low oil consumption in "heavy duty" service. Its use by other engine builders may be expected. For the immediate future, present bearing materials are considered satisfactory with respect to strength, wear and corrosion and will be continued without important changes.

Certain automotive developments must await advances by the petroleum industry. This is especially true of engine changes requiring increases in anti-knock quality. On several occasions in the past, manufacturers have met with considerable difficulty when their future designs were based on anticipated increases in the anti-knock value of motor fuels which did not materialize. Now for the most part, year-to-year engine modifications are governed largely by existing fuels. For this reason the compression ratio trends shown in Figures 1 and 2 may not continue in the future. Increases in compression ratios can be more accurately predicted from octane number trends when conditions are normal. As a result of the rapidly changing octane values shown in Figure 3, and the present shortage of raw materials needed for the production of tetraethyl lead, only minor increases in compression ratios can be expected in the immediate future.

It is generally agreed that many present engines have reached or are approaching their maximum compression ratios. Most such engines, in order to utilize fully fuels which are expected to be available within the next two or three years, are believed to require basic changes which would necessitate re-tooling. Manufacturers of these engines are expected to incorporate in their basic designs features which will enable them to raise compression ratios in accordance with the increases in anti-knock values which are predicted for the future. These increases are shown in Figure 3. Some manufacturers are thought to be in a position to keep abreast of the predicted fuel trends for several years by increasing compression ratios and by other engine modifications. All engine builders are expected to follow fuel trends more closely in the future than in the past. Truck engines are expected to be outstanding in this respect. Fluid couplings, semi-automatic transmissions and fully automatic transmissions, contrary to expectations, have had little or no effect on the fuel requirements of the engines with which they have been used, all of which, it should be remembered, were designed for use with conventional transmissions. This may not hold true of engines designed to operate with special transmissions.

Compression ratios of 1947 model passenger cars announced to date are identical to those of the 1946 models. A few manufacturers are offering optional high compression heads, and one is producing a special low compression head for vehicles exported to countries having only very low octane number fuels.

What is believed to be one of the most significant engine developments in recent years and one likely to have a profound effect on both the automotive and petroleum industries is now under investigation. The research laboratories of one of the larger manufacturers is now demonstrating to its divisions two six-cylinder passenger cars which exhibit identical external appearances. In fact, except for their engines, they are identical in every respect. Only the most experienced driver is capable of detecting differences in their performances.

One car is equipped with an L-head production engine having a compression ratio of 6.2 to 1. The other is equipped with an engine which disproves much past thinking relative to compression ratios. It has been generally believed and on occasion demonstrated that engines having compression ratios above 8.5 to 1 were not practicable because of roughness and high frictional losses which absorb most of the increased efficiency. However, most such work has been conducted with production engines with special heads. This new engine has a compression ratio of 12.8 to 1 and was designed to match as closely as possible the performance characteristics of the production engine.

The writer has driven both cars and can report no detectable difference in the smoothness of the two engines. More experienced drivers believe the higher compression ratio engine to be smoother. Low speed acceleration of the car equipped with the high compression engine is slightly inferior to that of the production engine, the gear ratio not yet having been adjusted, but its overall performance characteristics are considerably better.

Preliminary dynamometer and road testing have indicated that a high compression engine of the type prescribed will show approximately 35 to 40 percent gain in fuel economy.

The new engine differs only in minor details from conventional passenger car engines. Thus far the new engine has been operated primarily on a fuel rated better than 100 O.N. Determination of the exact fuel requirement of the engine is expected to show that fuels capable of giving satisfactory performance in the engine are within

Figure 4. Chrysler Corporation's Fluid Drive (left) and Hydraulically Operated Transmission. (Courtesy of Ross Roy, Inc.)

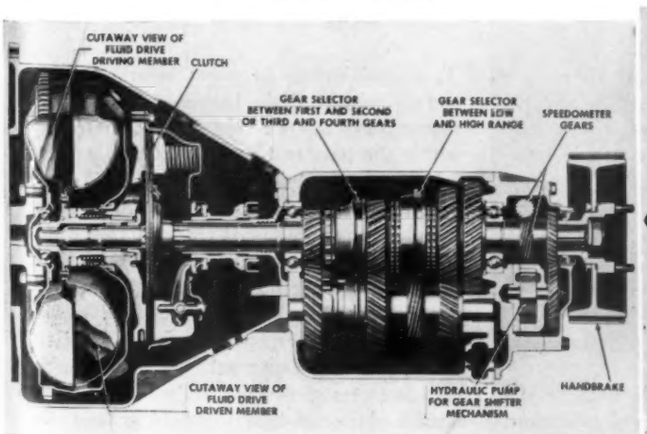
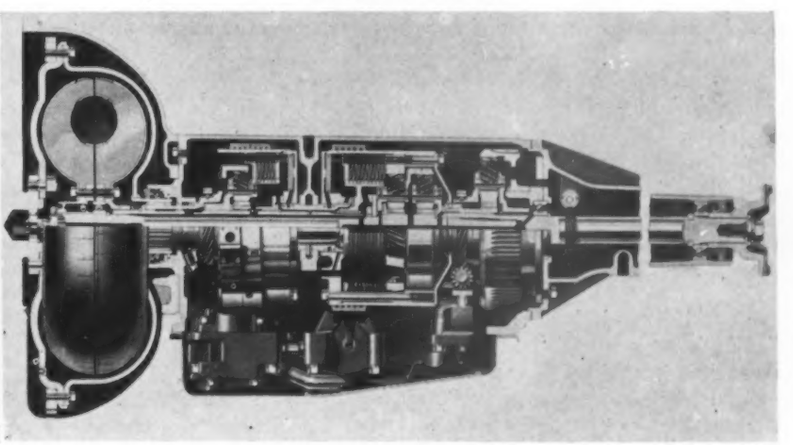

CUTAWAY VIEW OF FLUID DRIVE DRIVING MEMBER
CLUTCH
GEAR SELECTOR BETWEEN FIRST AND SECOND OR THIRD AND FOURTH GEARS
GEAR SELECTOR BETWEEN LOW AND HIGH RANGE
SPEEDOMETER GEARS
CUTAWAY VIEW OF FLUID DRIVE DRIVEN MEMBER
HYDRAULIC PUMP FOR GEAR SHIFTER MECHANISM
HANDBRAKE

Figure 5. Cadillac-Oldsmobile Type Hydra-Matic Transmission. Courtesy of Cadillac Motor Car Division, G. M. C.)



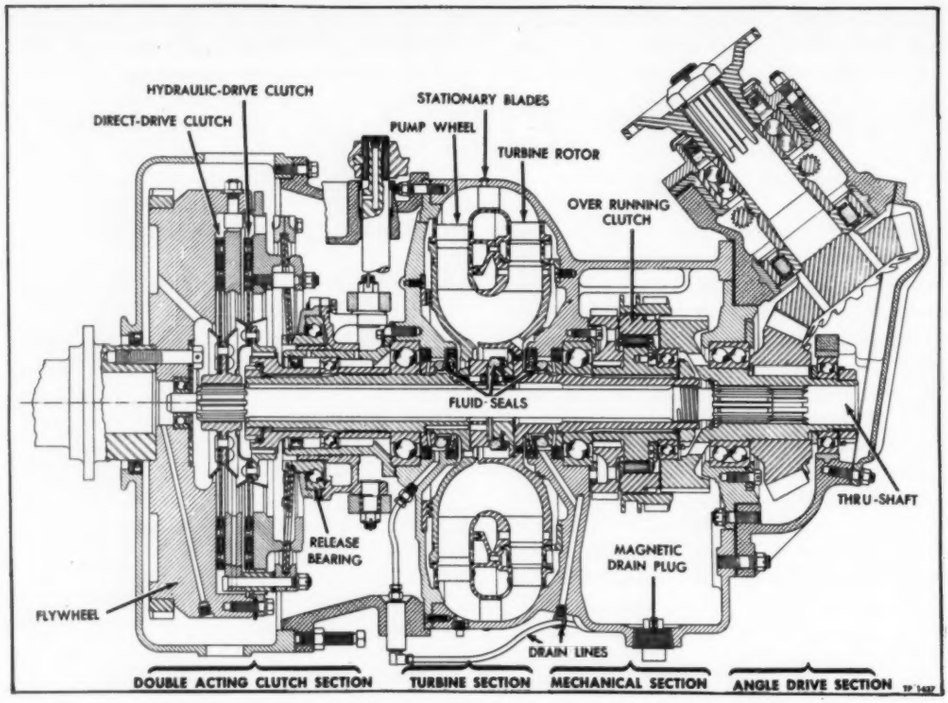


Figure 6. G. M. C. Model 90 Hydraulic (torque converter) Transmission and Clutch for Busses. (Courtesy of Truck & Coach Division, G. M. C.)

the predictable future. These results and more detailed information regarding the engine are scheduled to be released in June of this year. Manufacturers having new engines at various design states are expected to give serious consideration to this development, so that future basic designs may be altered to enable compression ratios in the range of 15 to 1 to be reached without retooling, rather than the much lower top limits which are believed to have been set.

It should be understood that the high compression ratio engine mentioned here is solely a research instrument. The significance of this development to the petroleum industry lies in the fact that there appears to have been made available to the automotive industry a means of keeping abreast of improvements in fuel quality for many years to come with an engine conventional except for compression ratios. It is believed that compression ratios in excess of 12.8 to 1 are likely to result in further improvements in fuel economy and are scheduled for investigation.

The question of price as well as the availability of fuels suitable for high compression engines has been raised. The work on this engine has demonstrated that the limits which many people believe to exist in the automotive industry are not real. In a similar manner progress in the petroleum industry may not be as limited as some people believe.

Since a fuel that is high enough in resistance to knocking is not commercially distributed at the present time, it is evident that this engine cannot be adopted for mass production until such fuels are available. Increases in compression in engines in large volume and increase of knock resistance of fuels that are commercially distributed must depend upon each other, and such changes are somewhat gradual.

Fluid couplings, semi-automatic transmissions and fully automatic transmissions have created a public demand for "effortless driving" which is certain to be reflected in future production. The importance of this trend to the oil industry can be best illustrated by a brief review of these units.

The fluid coupling shown in Figure 4, which is now standard equipment in all Chrysler, DeSoto and Dodge passenger cars, required 6½ quarts of a high-quality light lubricating oil containing an oxidation inhibitor. While the manufacturer does not recommend that the fluid be changed at any definite interval, eventually an appreciable volume will be required for replacement. This together with the volume of product required for the initial fill of new production is already sufficient to warrant attention.

It is estimated that 95 percent of all postwar Chrysler and DeSoto passenger cars are equipped with the hydraulically operated transmission shown in Figure 4. This unit has a capacity of three pints. Owners are instructed to drain and refill with No. 10-W engine oil every 10,000 miles. The continued production of these units in time will effect a reduction in the requirement for conventional type gear lubricants but will increase the volume of low viscosity motor oils which must be supplied.

Approximately 80 percent of all Cadillac and Oldsmobile passenger cars produced subsequent to V-J Day as well as a considerable number prior to the war were equipped with Hydra-Matic transmissions, of the type shown in Figure 5. The Oldsmobile Hydra-Matic has a capacity of 11 quarts, and owners are instructed to have these units drained and refilled every 15,000 miles. The Cadillac Hydra-Matic has a capacity of 12 quarts, and the recommended drain period for this unit is 12,000. While specifications for Oldsmobile and Cadillac Hydra-Matic fluids have not been released, there are believed to require a highly refined, medium viscosity mineral oil containing several additives. The requirement for conventional transmission lubricants for these two passenger cars is being eliminated, and the demand is being created for an appreciable volume of high quality low viscosity motor oil stocks.

The extension of fluid couplings and some form of automatic or semi-automatic transmission to the more popular priced cars is predicted for the near future when the market becomes more competitive. Present types of fully automatic transmissions are expected to be replaced at an early date by less costly equipment which will provide the same degree of effortless driving. Petroleum requirements of the replacement units being considered are likely to remain substantially the same both with respect to volume and quality.

Hydraulic torque converters were first employed on vehicles in this country by the Yellow Truck and Coach Company (now the Truck and Coach Division, General Motors Corporation,) on certain of their busses in 1938. Today this equipment (see Figure 6) is incorporated in 85 percent of their total bus production. During the past year several other bus manufacturers and one truck manufacturer have announced its adoption. To date mixtures of kerosene and motor oil, diesel fuel, mineral seal oil and exceptionally light lubricating oils have been used in hydraulic torque converters with varying degrees of success. Light lubricating oils are believed to be the most satisfactory when properly inhibited for improved stability and the prevention of corrosion. The use of hydraulic torque converters on commercial vehicles can be expected to increase at a rapid pace in the next years. The volume of products which is likely to be required for truck and bus application is expected to be appreciable.

Trade publications in recent months have frequently mentioned the likelihood that hydraulic torque converters will appear on passenger cars within the next two years. While every effort is being made to develop units capable of utilizing conventional motor oils, at this writing they are expected to require special products, compounded from medium viscosity motor oil stocks. This development has not reached the stage where it is possible to predict the volume of fluid required per unit, but it is expected to equal if not exceed the capacity of present crankcases. Assuming that manufacturers offering this equipment will recommend a change of hydraulic fluid at least every

10,000 to 15,000 miles, the volume of new business which might result from the application of hydraulic torque converters to any appreciable volume of passenger cars becomes evident.

The possible utilization of full hydraulic drives by passenger cars has been discussed on several recent occasions in trade publications. Such developments normally require many years of research and development, and while the introduction of such equipment appears remote, it warrants some thought because of the volume of petroleum products which it would require and the reduction in sales of transmission and rear axle lubricants which it could effect. To demonstrate the feasibility of the principles involved, an experimental passenger car employing a hydraulic drive has been produced and exhibited by Hydraulic Machinery, Inc. Figure 7 shows the principal components of the experimental car; a hydraulic pump connected directly to the engine drives a hydraulic motor coupled to the propeller shaft. Next step in the development is to adapt hydraulic motors to the rear wheels, eliminating propeller shaft and differential. The hydraulic system of this experimental unit requires 25 gallons of fluid. For the present, however, work on this particular project has been suspended.

Early changes in passenger car rear axles which would affect the petroleum industry are not likely. Hypoid bear tooth pressures and wiping velocities are believed to have reached the maximum limits permitted by current designs and lubricants generally available throughout the country. Manufacturers are expected to be guided accordingly. Spiral bevel gears are expected to disappear from passenger cars soon. The extension of hypoid gears to heavy-duty trucks, which began in recent months, is a trend likely to continue.

The figures in Table I reflect the recommendations of passenger car manufacturers with respect to the number of different lubricants specified per vehicle and the number of lubrication points per vehicle for the period 1936 through 1947. The average number of different lubricants required per vehicle declined from 7.8 in 1936 to 6.9 in 1942 and has remained unchanged since then. The current trend is expected to continue, notwithstanding the satisfactory results obtained by the Armed Forces in the recent war with a much smaller number of products. The increase in the average number of lubrication points per vehicle occurring between 1942 and 1947 is not expected to continue. A gradual return to the low of 32.9 for 1941 models is hoped for.

Completely opposite opinions appear to be held by two of the larger car manufacturers with respect to the value of oil filters. One has eliminated oil filters from all but one line of passenger cars, while the other has extended their use and on some higher-priced models is offering the full flow type as standard equipment.

The production of agricultural type tractors is expected to increase with increasing numbers being manufactured in or exported to foreign countries. Many prominent economists believe that only through increased farm mechanization will most European and Near East countries attain a higher standard of living and a more satisfactory economic condition. Since any one model tractor may be used in practically every country of the world within the next few years, most tractor manufacturers desire to have fuels of minimum anti-knock quality (70 A.S.T.M. octane number) available throughout the world for farm use. Until this is accomplished, tractors in many foreign countries will be modified to use tractor fuel, kerosene and heating oils

As in the automotive industry, tractor manufacturers are testing and developing semi- or completely automatic-transmissions. It does not appear, however, that their adoption will take place for several years. The increased use throughout the world of hydraulic controls for farm implements introduced by Harry Ferguson, Inc., is expected to result in large demands for hydraulic fluids and dual purpose transmission and hydraulic system lubricants.

Increased numbers of improved farm implements can be expected in the next few years. Farmers in the United States do not expect a return to prewar economic conditions and increased mechanization to permit more work in a shorter time is believed to be the best answer to the present labor problem. The increased number of tractors and farm implements will, of course, result in a greater demand for fuels and lubricants. Also the farmer is becoming more maintenance-conscious and is expected to make more extensive use of rust preventive materials which have been made available for this purpose by the petroleum industry.

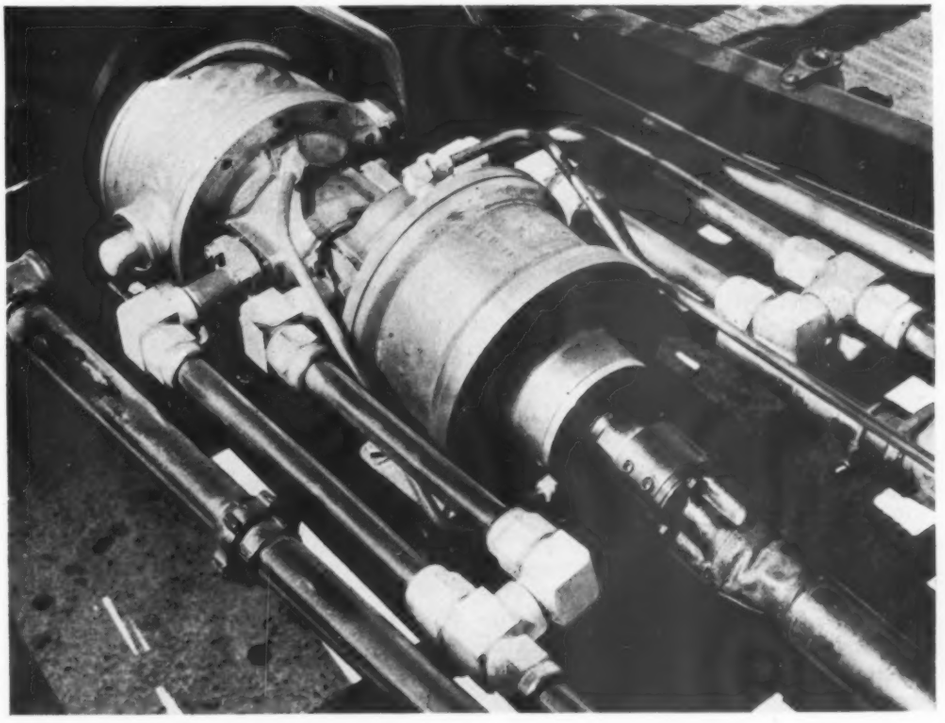
Of interest to the petroleum industry are the two entirely new "heavy duty type" marine engines just announced by the Packard Motor Car Company. These engines are designed for both shallow-draft work and pleasure craft. They will have displacements of 235 and 346 cubic inches and are rated at 100 and 150 horse power respectively. Compression ratios for both engines will be 7.0 to 1, which is somewhat higher than average for engines of this type and will require 70 or higher A.S.T.M. octane number fuel. Crankcase capacity of the 100 hp. engine is seven quarts and that of the 150 hp. engine nine quarts. Hydraulically controlled reverse gears are standard equipment on both engines. A separate oil system having a capacity of two quarts is provided for the hydraulic mechanism. Engine oil of the same S.A.E. number as that used for the engine is recommended for the hydraulic system.

TABLE I—PASSENGER CAR LUBRICATION TRENDS

Year	Average No. Lubrication Points	Greatest No. on Any Car	Lowest No. on Any Car	Average No. Different Lubricants Used
1936	38.0	45	24	7.8
1937	37.7	48	24	7.5
1938	36.4	46	24	7.3
1939	34.7	45	21	7.2
1940	34.4	48	21	7.2
1941	32.9	43	18	7
1942	33.3	43	18	6.9
1946	36.4	46	29	6.9
1947	36.8	48	25	6.9

(Courtesy of Chek-Chart Corporation)

Figure 7. **Experimental Hydraulic Drive for Passenger Cars Developed to Demonstrate Feasibility of Such Equipment. Capacity of Hydraulic System—25 Gallons. (Courtesy Hydraulic Machinery, Inc.)**



ITALY'S OIL INDUSTRY MAKING PROGRESS

Increased Use of Petroleum Products Main Hope of Industrial Recovery in View of Continuing Shortages of Coal and Hydroelectric Power—Activity of Radicals a Hampering Factor

STATEMENTS that have been made from time to time, apparently with official authority, created a general impression that the regulations and restrictions that have been imposed on the Italian oil industry since the close of the war would be removed with the coming of 1947 and that there would be a free market for petroleum products. As far back as the end of last summer when an agreement was made with Standard Oil Company of New Jersey, Socony-Vacuum and the Royal Dutch-Shell Group, it was understood that the purpose in view was to restore marketing operations to the companies that formerly had been engaged in such activities. Subsequently it was published that the Comitato Italiano Petroli (Italian Petroleum Board) which had been handling the distribution of oil products since the arrival of the Allied forces was to cease operations on December 31 last, but that it would be succeeded by a corporation, the capital of which would be supplied 50 percent by the State and the remaining 50 percent by private users and importers of petroleum and its products.

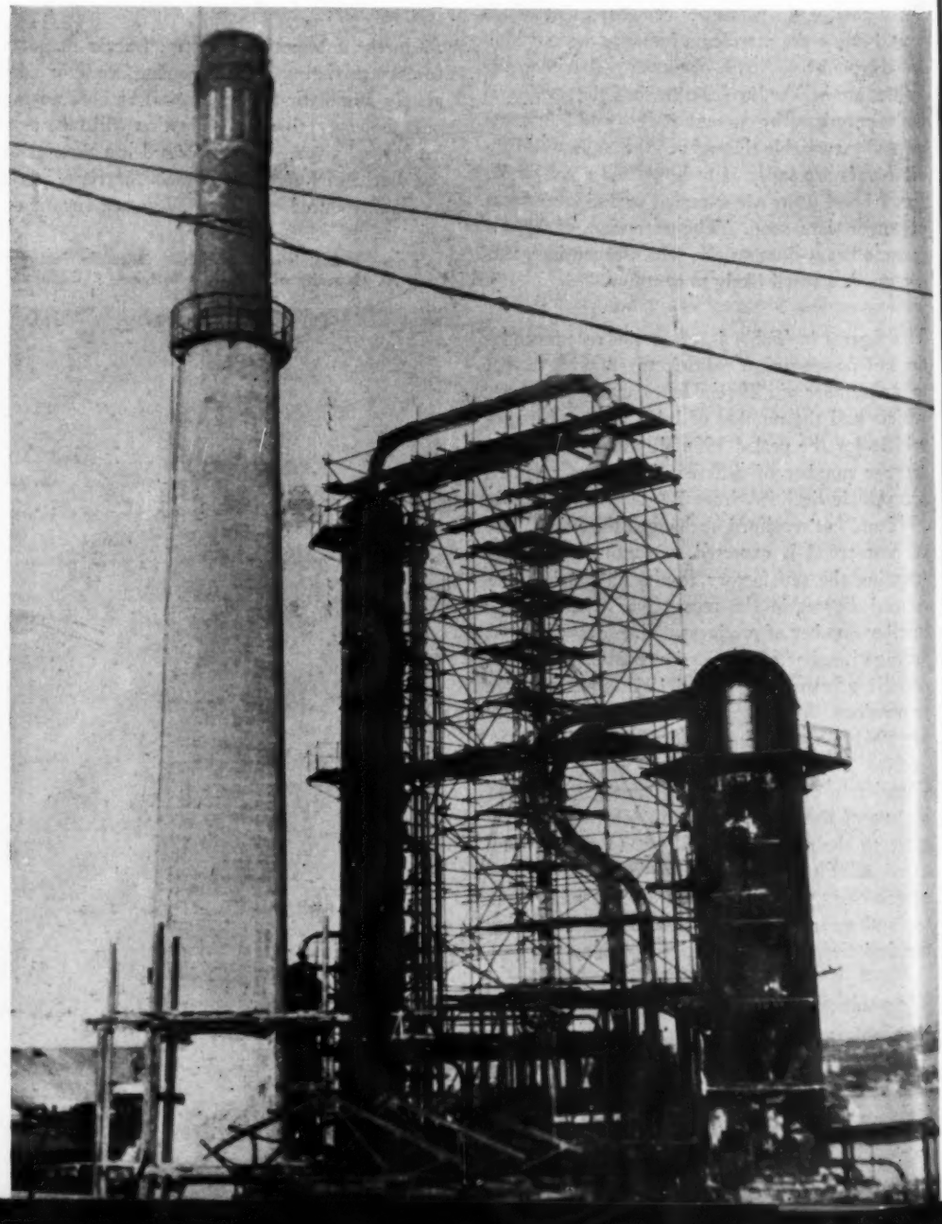
The precise purpose of this organization and the extent of its duration never have been fully defined. It was supposed to have charge of the allotment of supplies among distributors in case available quantities, as seemed inevitable, should remain inadequate to satisfy all needs. It was expected to deal with oil brought in for refining plants by the UNRRA. It was reported some time ago that that organization had awarded a contract to Arabian-American Oil Company for one million barrels for use in Italy to be delivered the next few months. It was explained that the corporation was needed during the transition period pending the settlement of the country's monetary problems which prevent the buying of materials from foreign countries by private interests, but in some quarters it is held that the intention of the government is to retain control over the importation of needed materials and products.

One reason for the failure of the government to adopt a definite policy is that its own position is far from secure. It is constantly under pressure, particularly from parties of the left who advocate the exclusion of foreign oil interests and urge that the State set up a monopoly or at least restrict the oil trade to Italian companies. An illustration of this attitude is the opposition raised to the grant of an exploratory concession in Sicily to the Macmillan Petroleum Corporation and the demand that AGIP (Azienda Generale Italiana Petroli) be authorized to carry on exploration with the facilities available in the country.

Under the Fascist regime, AGIP enjoyed the special favor of the government then in authority, but its present position is reflected by its last report which showed a loss of roundly 80,000,000 lire after writing down the value of its assets by 103,000,000 lire. For the year 1945 its loss was 70,000,000 lire. The total of 150,000,000 for the two years represents 15 percent of the capital. Under these circumstances the company obviously is in no position to undertake extensive exploration. As its last report reveals, the activities along this line were confined to the Lodi district where showings of gas were found, encouraging further drilling.

While referring to the position of AGIP, it may be noted that the company's refineries are reduced to three—at Porto Marghera (Venice), Naples and Vado Ligure, the plant at Fiume having been seized by the Yugoslav government. These refineries all were badly damaged during the war and repairs thus far made provide only for operation at part capacity. The plant at Naples is now at work, running Arabian crude, and the one at Porto Marghera is expected to resume during the first quarter of 1947. The hydrogenation plant of ANIC (Azienda Nationale Idrogenazione Combustibili) at Bari also has been put into operation, handling some 25,000 to 30,000 tons of crude monthly and producing gasoline and a certain amount of fuel oil. The Leghorn refinery of the same company is still out of com-

"AQUILA" refinery at Trieste after its almost complete destruction by air raids.



mission pending arrangements for obtaining the machinery and materials needed to repair the damages inflicted by air raids during the war.

Relatively little damage was inflicted in the course of war operations upon the smaller refineries under native ownership, such as those at Milan, Genoa, Fiorenzuola d'Arde and in the vicinity of Florence. These are all in operation, but their combined output is relatively small.

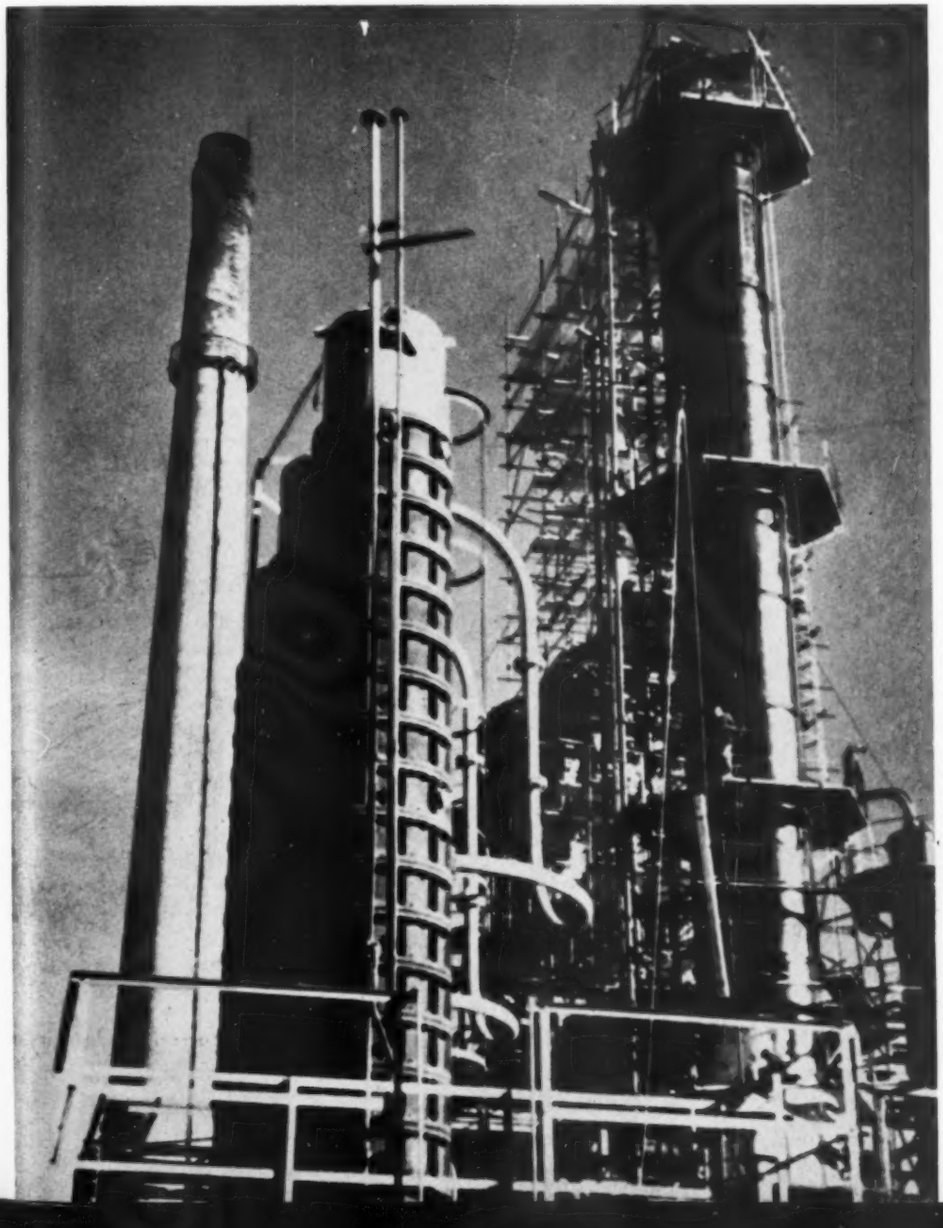
Of the larger plants owned by British and American interests, none escaped injury, and in some cases this was so serious and extensive as to require virtual reconstruction. Extensive repairs have been made at the Naples refinery of Vacuum Oil Company, and it is handling 35,000 to 45,000 tons of crude monthly. This, however, is not enough to meet the company's needs, and it has arranged to take part of the output of the Bari refinery. Vacuum's plant was one of the newest and most efficient of the country's refineries before the war, and additional improvements are planned for incorporation in it including a catalytic cracking unit and an installation for the production of lubricating oils which are needed by Italian industry.

La Spezia refinery of the Royal Dutch-Shell Group is now undergoing rehabilitation and is expected to be in working order during the early months of the current year. Refineries of Standard Oil Company and the Aquila Company in Trieste both suffered heavy damage. Accompanying photographs illustrate the extent to which the Aquila plant has been reconstructed despite the unsettled political situation.

Before the war Italian refineries had a capacity of from 2,500,000 to 3,000,000 tons of crude oil yearly. This capacity now has decreased to 1,500,000 tons (10,500,000 barrels) yearly which is not sufficient to meet the requirements of the Italian market, especially with the growing tendency to employ oil and oil products in the production of power and for traction purposes. Evidence of this can be seen in the increasing number of Diesel electric plants which are being built to escape the shortage of coal and hydroelectric power. One of the latest Diesel electric plants was built at Messina where about 20,000 h.p. is developed by three Fiat engines.

Another noteworthy development is the order for Diesel locomotives which the Italian state railways have placed with Italian Diesel engine builders. To remedy the shortage in refining capacity and to avoid the necessity of importing products, there has been some discussion of the construction of a new large refining plant in Genoa in connection with the creation of the free port in that harbor. In such a way it is expected to render possible the refining in Italy of all the petroleum products required by the market. Incidentally a proposal has been advanced for a pipe line from Genoa to southeastern Switzerland to supply crude to the refinery being built in that district.

Reconstruction of the "AQUILA" refinery at Trieste is well advanced.



It would be useless, however, to start rebuilding the Italian oil refining industry and enlarge it unless provision is made for storage facilities at coastal points. The shortage is evidenced by the difficulty which the Arabian-American Oil Company is said to have experienced in finding storage for 100,000 tons of oil, the available tanks having a capacity of only 60,000 tons.

It is certain, however, that unless something is done to reestablish the normality of the Italian oil products market through free imports and free commerce, it will be impossible for the economic reconstruction of the country to develop. Italy receives at present (when there is no strike abroad) only 40 percent of the coal imported in prewar times, while electric power is 2,500,000,000 Kwh. short, and it does not appear that the situation will improve materially before 1950. Under these circumstances it is evident that industrial activity must depend mainly upon oil, but at present, even with the new arrangements arising from the September 1946 agreement between the Italian government and the foreign oil companies working in Italy, and with the resumption of the activity of the Naples and Bari plants, the supply of petroleum products is but 45 percent of the imports in prewar times. In consequence of currency difficulties, the Italian government is not encouraging larger purchases. The Ministry for Foreign Trade has made efforts to obtain additional supplies in exchange for Italian goods and 60,000 tons of petroleum products have been obtained in this way from Hungary, but it is evident that such a quantity does not go far toward improving the situation. As an index of the shortage it may be pointed out that between January 1 and December 31, 1946, the price of petrol in Italy increased on the black market from 100 to 280 lire a liter.

There is a strong hope in trade circles that, as a result of the visit of Premier Gaspari to the United States and the arrangements made for future loans, more stable conditions may be established and enable Italian industry to work its way back to a better position. Nothing else would do more to strengthen the position of the government and to curb the effect of demands being made by radical elements. There is no question that the oil companies serving the country stand willing to cooperate by expanding their facilities, once a reasonable degree of security is assured.

SHELL RECOMPLETES OLD CALIFORNIA WELL WITH *HORIZONTAL DRAINS*

Turbine bit, curved drill pipe and mandrel used to hold drill pipe straight while running in the well.

ABOUT a year ago a California engineer, John A. Zublin, announced that he had developed a method of drilling horizontal drains from a vertical bore hole of conventional diameter. His method was designed to achieve the same result which had been attempted in the oil mining experiment of a group of producers in Western Pennsylvania, viz., to increase vastly the sand face in a well available for drainage. In the Pennsylvania operation, however, it was necessary to sink a shaft to the formation before the drifts or drains could be drilled. Zublin claimed that this expense could be eliminated.

Recently Shell Oil Company, Inc., has completed a test of the new method in an old well in the Round Mountain field of Kern County. This experiment was in the application of the Zublin technique as a secondary recovery method. Thus far no producer has used the equipment in the initial completion of a well.

The Shell well originally was drilled to a total depth of 1,720 feet. Casing was set at 1,381 feet and a 6⅝-inch liner was hung from 1,354 to 1,718 feet. The liner was perforated from 1,379 to 1,718 feet, although the main oil sand was concentrated in the bottom 80 feet.

Recompleted with Zublin equipment, the well now has nine horizontal drains which have increased the sand face open for production by 458 feet. Average penetration of each horizontal drain hole was 51 feet. Maximum penetration was 60 feet. Starting depth of the nine drain holes was a 30-foot section of sand from 1,650 to 1,680 feet.

Principal elements in the Zublin drilling equipment are a turbine bit actuated by fluid pumped from the surface, a curved length of pipe to which the bit is attached, and a mandrel which holds the curved pipe straight while it is being lowered into the well to the point where horizontal drilling is to be undertaken. A non-magnetic sub and a magnetic compass are used to orient the bit so that the desired pattern of horizontal drains can be drilled.

The turbine bit is only 20 inches long, so that it can turn a sharp corner. The assembly consists of three main parts: a housing which carries the nozzles of the turbine, the shank member carrying the ball-bearing turbine runner and the cutter element itself which also is equipped with ball bearings and is free to rotate about an axis that is inclined with respect to the axis of rotation of the shank. This inclination of the bit itself with respect to the shank materially assists in the sharp angle at which the horizontal drains take off from the vertical bore hole.

The flexible drill pipe is made of 4½-inch external flush joint drill pipe into which a continuous spiral slot is cut in each joint except at a distance of 15 inches from each end. The slotted pipe is lined with high-pressure, oil-resistant synthetic rubber hose to permit circulation of drilling fluid. This liner limits drilling fluid pressure to some extent. In the Shell well pressures on the order of 900 psi. were employed.

In each string of Zublin Flexpipe the bottom joint is bent to a desired radius and heat-treated so that this curved form will be maintained. Radii of curvature range from 20 to 30 feet. In the Shell well a 25-foot radius joint was used for seven drain holes and a 30-foot radius joint was used for two drains.

Before the drilling string is lowered into the well it is necessary to straighten the curved joint. This is done by inserting a mandrel in the joint which is straightened out and clamped in that position for the purpose. When the joint has been lowered to the desired point, the mandrel is removed with a sand line, and the drill pipe tends to resume its curved form as much as the diameter of the hole will permit. This forces the bit against the wall so that the drain can be begun.

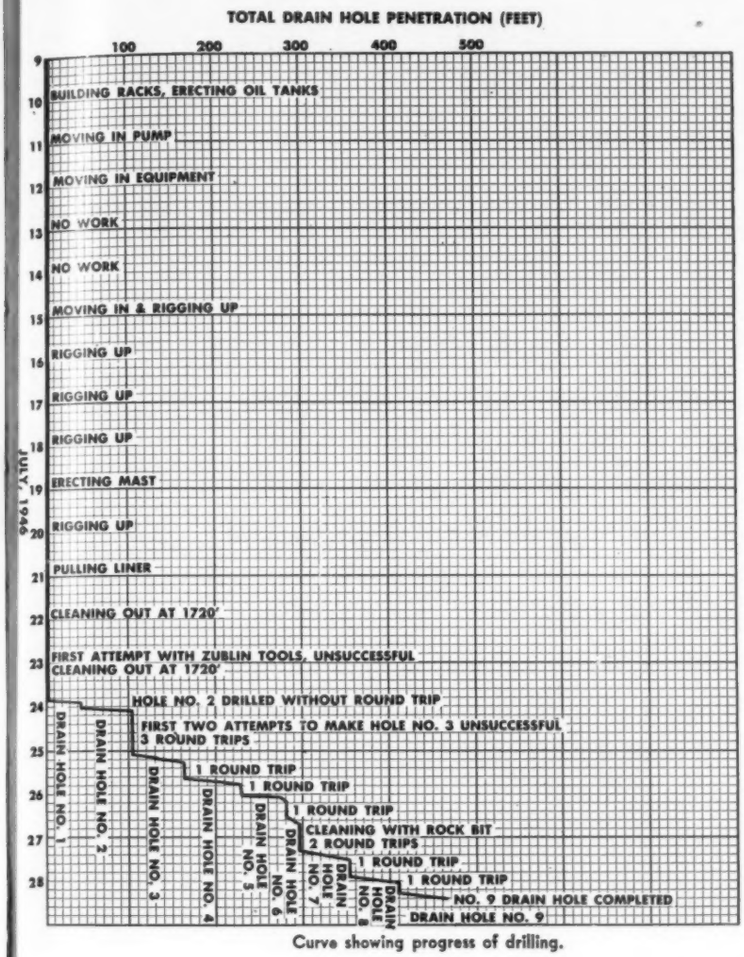
Mr. Zublin states that pressure on the drill pipe and the force of gravity causes the curved drill pipe joint to continue in a horizontal direction, once the turbine bit has completed the 90-degree arc.

Drill string in the Shell well consisted of three 20-foot sections of straight Flexpipe and one 20-foot section of curved pipe. It is stated that by using additional lengths of Flexpipe that the horizontal drains could be extended much further, to 80 or 100 feet. An accompanying sketch shows the make-up of the string in the Round Mountain well.

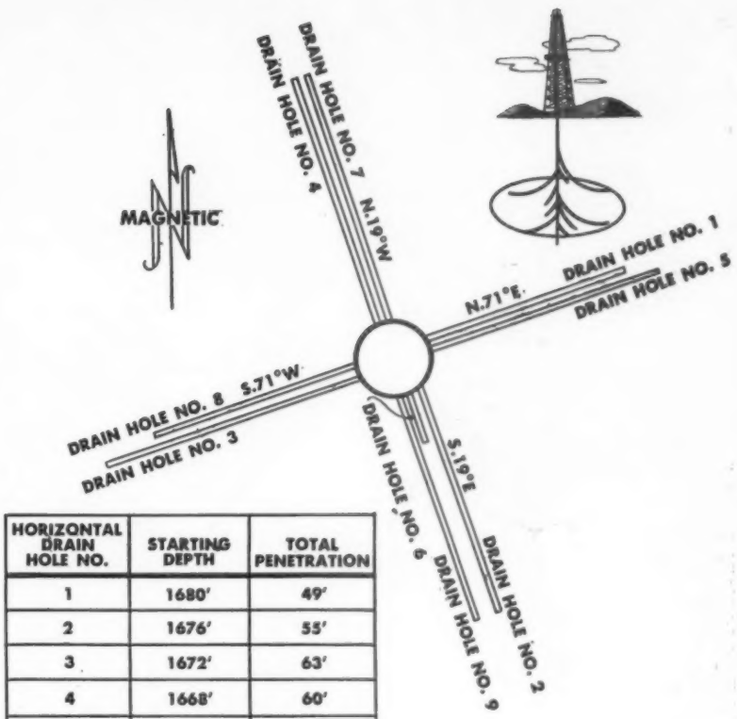
Before drilling is begun, it is necessary to orient the bit in the desired direction. This is made possible by precise alignment of the drill pipe and with the aid of a magnetic compass assembly. All joints of Zublin Flexpipe and subs from the curved joint, up to and including the non-magnetic sub, have vertical alignment marks chiseled in the end of each joint. With the aid of a protractor these marks provide means for determining the relative angles of adjacent joints. Bearing of the bit with respect to the non-magnetic sub is determined before the drilling string is run. It then only becomes necessary to determine the exact compass bearing of the sub to permit rotation of the drill pipe to the exact point desired.

Position of the non-magnetic sub is determined by running a magnetic compass on a sand line into the 7-foot 10-inch stainless steel sub which is equipped with an internal slot to insure positive orientation of the compass itself. The compass needle is allowed sufficient time to come to rest, after which a mechanism within the compass housing locks the needle in position so that it may be inspected when withdrawn to the surface. After necessary calculations are made, the drill pipe is rotated to the desired point, and drilling is begun. In the Shell well two of the drain holes were oriented in this manner, and seven were oriented by surveying the holes, rotating the pipe and pulling the mandrel. This necessitated a round trip for each new drain hole, since the mandrel can only be inserted when the curved pipe is at the surface so that it can be straightened.

When drilling is commenced, the drilling fluid is pumped from the surface to actuate the bit. The turbine bit has a gyrating cutter having twelve radial cutting edges, each containing a number of teeth. The maximum speed of the turbine is 4,000 rpm under load. However, as the bit engages the formation at the bottom of the hole, the gyrating motion of the cutter causes the twelve cutting edges to penetrate the formation, one at a time, forming a gear pattern similar to the tooth pattern of the cutter. Since the teeth of the cutter are geared to the

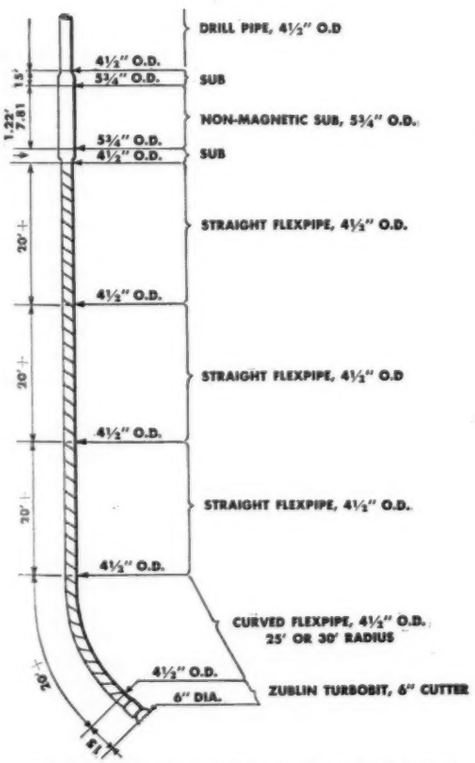


Curve showing progress of drilling.



HORIZONTAL DRAIN HOLE NO.	STARTING DEPTH	TOTAL PENETRATION
1	1680'	49'
2	1676'	55'
3	1672'	63'
4	1668'	60'
5	1664'	54'
6	1660'	13'
7	1660'	60'
8	1656'	49'
9	1650'	55'

Diagramatic sketch showing scheduled orientation of drains.

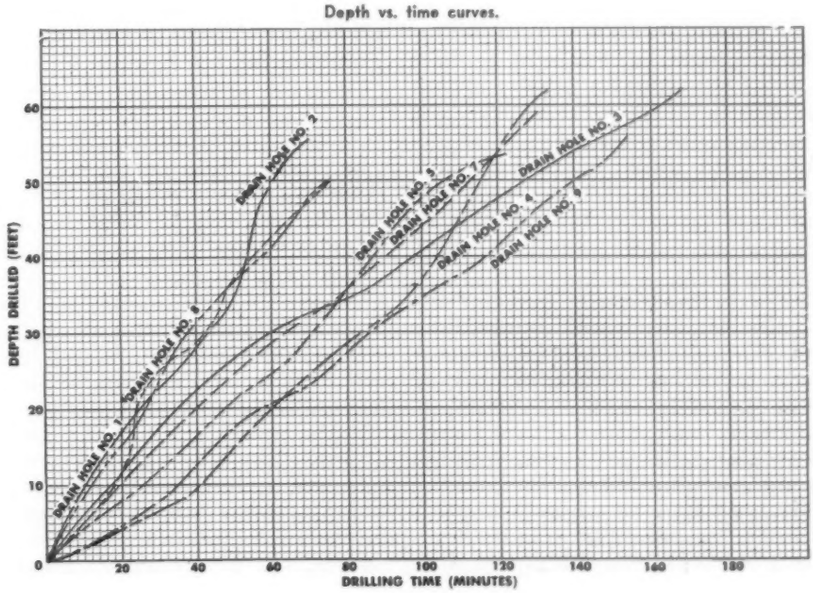


Sketch of tool string used in drilling horizontal drains.

bottom of the well, the 4,000 rpm of the turbine causes the cutter simultaneously to gyrate, at the rate of 4,000 blows per minute, with a small, forward, rotating motion, averaging one-tenth of that of the turbine. This action resembles an air-hammer.

Drilling fluid used on the Shell well was oil. A supply of 4,500 barrels was provided to make up for drilling losses. Loss was confined to 450 barrels while removing the liner and 650 barrels lost into the formation while drilling. Total loss was 1.4 barrels per foot of hole drilled. Desired rate of circulation is 6/10 barrels per minute, and pressure in the drill pipe must be held below 900 psi. to prevent rupture of the rubber liner. Recommended weight on the bit is 1,000 pounds.

Depth vs. time curves.



The Scripps Institution of Oceanography in California is the site of microbiological work carried on under A.P.I. Project 43A which now appears likely to have great importance in secondary recovery operations.

BACTERIA
HELPS TO PRODUCE OIL

SEVERAL years ago the American Petroleum Institute sponsored an investigation known as API Project 43A under the Scripps Institution of Oceanography. The object of the project was to study the chemical composition, physico-chemical characteristics and the bacterial composition of long cores of recent marine sediments, with particular reference to the biochemical activities of bacteria found in such situations.

The idea behind the project arose from the theory that bacteria might be the cause of the decomposition of organic materials buried in marine sediments, and ultimately of the formation of petroleum from the products of decomposition. If that were so, such a study might supply geologists and oil prospectors with a knowledge of the characteristics of source beds and thus help them to locate oil fields.

The work was put in charge of Dr. Claude F. ZoBell, microbiologist of the Scripps Institution. Work was begun on cores from selected localities where new source beds seem to be in process of formation. Many sediment samples were collected, and bacterial cultures were assembled, and the petroleum industry cooperated by providing samples of reservoir fluids and other materials. At the same time the literature on bacterial activities was combed for useful hints.

The result to date has been the gathering of some surprisingly interesting information, which not only throws much light on the possible origin of petroleum, but has also given some rather pointed hints on possible improvements in oil production, particularly in relation to secondary recovery. This latter phase of the investigation has been regarded by the API as important enough to be patented, in order that the principles brought to light by this project might be available to the industry in general. These principles have been embodied in U. S. Patent No. 2,413,278, issued in the name of Dr. ZoBell on December 24, 1946, for recovery of oil from subterranean deposits.

The investigation disclosed that active bacteria are widely and abundantly distributed in recent sea and lake sediments. There is conclusive evidence that living bacteria occur and may be active in sediments of considerable antiquity. For example, bacteria were found in cores of sulfur-limestone-anhydrite formations at 1560 feet; these bacteria are unlike any known species found in the air, water or soil at the surface of the earth, and similar finds have been reported at depths of up to 3600 feet. Dr. ZoBell himself found sulfate-reducing bacteria and fat-splitting bacteria of peculiar types as deep down as 6000 feet. Evidence has been collected to show that living bacteria are most abundant in Tertiary formations and gradually disappear in the Cretaceous, Jurassic, Permo-Triassic and Triassic formations.

Dr. ZoBell also collected information showing that certain bacteria can survive underground temperatures as high as 196°F., underground pressures as high as 30,000 lbs. per square inch and brine concentrations of up to 30 percent. It is thus clear that there are kinds of bacteria that can carry on their life processes under conditions that prevail at great depths in the earth's crust.

There is now little doubt that bacteria can produce hydrocarbons. This they do by robbing buried organic matter of its oxygen, nitrogen, sulfur and phosphorous, leaving behind residual materials of hydrocarbon character. It is common knowledge that certain anaerobic bacteria produce enormous quantities of methane (principal constituent of natural gas). Ethane, propane, pentane and butadiene have been found in sewage sludge where bacteria were growing. Besides that, it is known that bacteria can produce hydrogen by fermentation of organic matter, and that this hydrogen may reduce carbohydrates to hydrocarbons. It is generally recognized that processes likely to end up in conversion of marine sediments to oil is now going on in favorable conditions such as are found in certain parts of the Pacific and in the Black Sea. Bacteria from such locations are found capable of transforming the albuminous materials and fatty acids of sea ooze into natural gas and dark-colored oil-like products having a bituminous odor. The first action, apart from the production of methane and other petroleum gases, appears to be the formation of compounds of high molecular weight. At that point another kind of salt-water bacteria takes over—the sulfate-reducing organisms which are able to assimilate carbon from these heavy hydrocarbons and thus lower their density. All in all, it begins rather definitely to look as if crude oil is actually a bacterial product.

While it is interesting to know that there are several ways in which bacteria may have been instrumental in the formation and accumulation of oil, the fact that bacterial cultures are capable of helping in the production of oil is of much more practical and immediate interest. And this is one of the important indications obtained by Dr. ZoBell in API Research Project 43A.

This idea resulted from an experiment in which it was observed that certain of these cultures released droplets of oil from test tubes filled with calcareous material prepared to simulate underground oil-producing formations. Further experiments showed that the bacteria were able to release oil from samples of Athabaska tar sands and Santa Mario oily shales. This was recognized as an important fact, and studies were begun as to why the bacteria could separate oil from such surroundings.

It turned out that some of these bacteria, the "thigmotactics," could physically displace films of oil from the surfaces of sediment particles, because of their marked affinity for solid surfaces; in growing on solid surfaces, these bacteria literally crowd the oil off and thus make it movable.

Then again, some bacteria produce acid, and hence can release oil which is on the surface of calcareous particles. Not only that, the acid enlarges the pore space between the particles; this makes it easier for the displaced oil to move, and the pressure of the carbon-dioxide formed by action of the acid on the limey particles gives the freed oil an extra boost on its way. Bacteria are very small organisms and hence are able to penetrate oil-bearing sediments of small porosity.

Bacteria have been found that promote the movement of oil in still another way. These particular organisms produce surface-active substances, otherwise known as detergents, which loosen the film of oil on the sand grains in much the same way as would soap. In other words, the detergents produced by the bacteria have been found

Dr. Claude F. ZoBell

to lower the surface tension of the media in which the bacteria are growing from 73 to 50 dynes per centimeter. When detergents are produced and released right on the surface of the material holding the oil, the oil is quite effectively released.

Since it is now known that living bacteria are widely distributed in sedimentary material and that they have the ability to displace oil films from particles of sediment, the practical problem is, first, to identify the species that will prove the most suitable and effective, and secondly, to increase their number to a point where they can produce large-scale results.

The bacteria that appear to be most suitable for putting this idea into effect belong to the Desulfovibrio genus; certain types of this genus require saline conditions for their growth and have been found to tolerate salt up to 300,000 parts per million, and are, therefore, at home in oil country brines. They are strict anaerobes, which is another requirement for organisms that are to live in airless surroundings. They are capable of growing in the presence of crude oil, from which they presumably obtain their mineral and nitrogen requirements. The one species that seems to possess all these qualifications in the highest degree is one which has received the name of *Desulfovibrio hydrocarbonoclasticus,* and the functions of this organism inspired the ZoBell patent for the recovery of oil which the API has dedicated to public use.

To put the idea into practice in an oil field, the first step is to prepare a culture of the bacteria for injection into the formation. Such cultures may be prepared in various ways.

One method is to prepare an aqueous brine solution containing from three percent to 30 percent of sodium chloride. The salinity of the brine should roughly correspond to the salinity of the subterranean formation which is to be inoculated with the bacteria culture. To the brine add 1.0 percent of calcium sulfate ($CaSO_4$), 1.0 percent of calcium carbonate ($CaCO_3$), 1.0 percent of calcium lactate ($Ca(C_3H_5O_3)_2$), and 0.1 percent of ferrous ammonium sulfate. This solution is then boiled to exclude atmospheric oxygen. After cooling the solution, add to it any of the source materials for bacteria having salinity requirements mentioned above. After introduction of the bacteria source material, the solution is maintained in any air-tight container. The incubation should be carried on in darkness for several days at a temperature between 70 and 180°F. The incubation temperature should correspond at least approximately to the previously ascertained temperature of the subterranean formation which is to be inoculated with the culture. The culture thus obtained is mixed with a large volume of water in which are dissolved the mineral salts required for the growth of any microorganisms, and then dumped into an existing well by means of a dump bailer or by a pump.

Once introduced in this manner into the oil formation, the bacteria may continue to grow and spread out. The rate of spread has not been measured, but in the laboratory it has been found that they will grow through a one-half inch thickness of unglazed porcelain within a few hours and that they will permeate tightly packed sand for relatively long distances in a short time.

An obvious field for the application of this invention is in secondary recovery projects, where the residual oil is no longer free-flowing and requires to be displaced by a suitable drive, preferably water. But even an efficiently managed water-drive does not completely dislodge the oil film from the surface of the sand grains, and it is here that the detergent and loosening action of the bacteria should be of material assistance.

Results of field trials on a large scale have not yet been reported, but the Pennsylvania Grade Crude Oil Association, which is very largely interested in secondary recovery, has for the past two years been cooperating in attempts to apply the discovery in their fields. While there are still technical difficulties to be overcome, the results so far are said to be sufficiently encouraging to warrant a continuation of the field experiments.

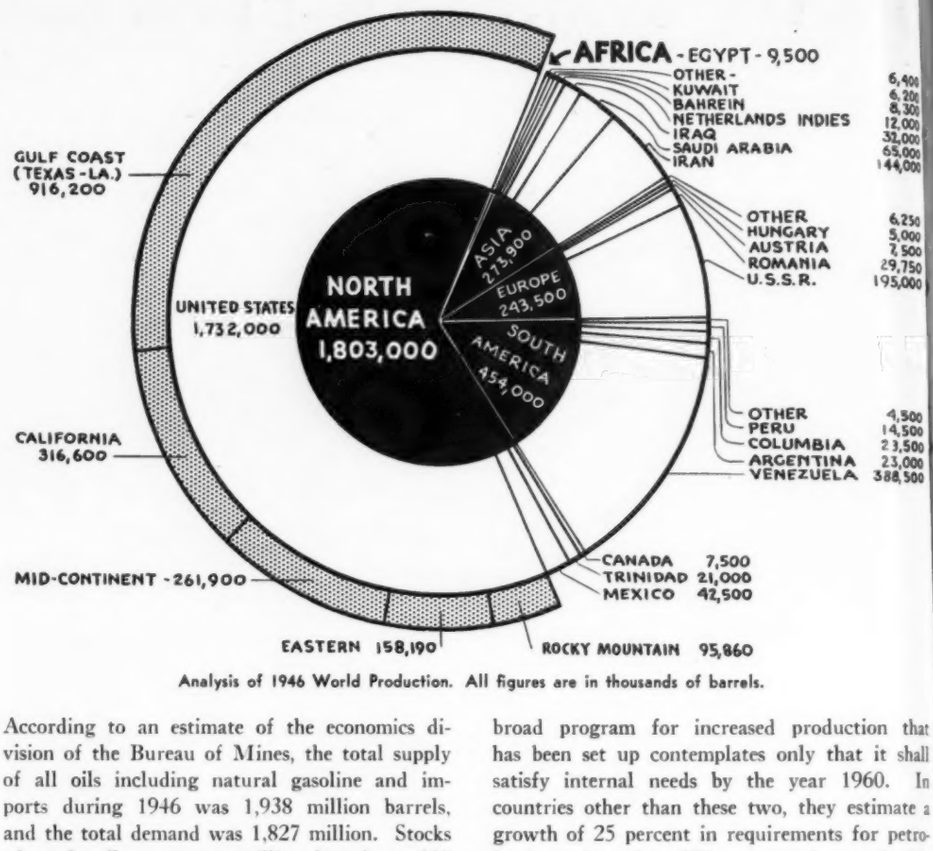
WORLD PRODUCTION 1946

WORLD production of crude oil reached its highest level in 1946 with an output of 2,784 million barrels, a gain of 167 million or six percent over the figure for the previous year. This advance was accomplished despite unsettled conditions in the Pacific area and in Europe that prevented fields from getting back to normal operation and despite shortages in materials and transportation that affected other parts of the world. At the close of the year production was proceeding at the rate of roundly 7.9 million barrels daily as compared with 5.6 million in 1937, the highest of prewar years. With a continuation of the present trend, the daily yield of the world's wells in 1947 will reach or exceed eight million barrels.

The United States maintained its preponderant position, supplying 62.2 percent of the world total. The greatest proportional gains over the preceding year, however, were made in Asia where rapid development of Arabian fields, the emergence of Kuwait as a producer and the continuing rise of Iranian output contributed to an increase of over 40 percent. In South America the expansion of Venezuelan production to 1,100,000 barrels daily in the latter part of the year gave a 17 percent increase to the southern continent. Venezuela is now firmly entrenched as the second largest oil producer, providing 14 percent of the total supply as compared with something under 10 percent prior to the war. Excluding the United States and the Soviet Union, two nations that are classed as self-sufficient, other countries provided 30 percent of the total oil outturn in 1946 as compared with 27 percent in 1945. This is a trend that is expected to become more pronounced as the demand for petroleum products becomes more widespread.

In the United States production bettered the high record of 1945 in all districts except the Pacific Coast and the Mid-Continent. In California the decrease was due to shutting back to about 25 percent the wartime output of the Elk Hills Naval Reserve. In Oklahoma there was a small decrease in each of the state's two largest fields. Texas maintained its long lead over other states by producing 43.7 percent of the total for the country. Output by districts as compared with 1945 was as follows in thousands of barrels:

	1946	1945
California	316,600	326,470
Rocky Mountain	95,860	86,000
Mid-Continent	261,900	263,000
Gulf Coast (Texas-La.)	906,200	886,100
Eastern	151,440	149,510
	1,732,000	1,711,080



Analysis of 1946 World Production. All figures are in thousands of barrels.

According to an estimate of the economics division of the Bureau of Mines, the total supply of all oils including natural gasoline and imports during 1946 was 1,938 million barrels, and the total demand was 1,827 million. Stocks of crude oil rose seven million barrels to 227 million, and stocks of refined products advanced from 175 to 205 million barrels. On the basis of current demand, all stocks are sufficient only for an average of 49 days and may be regarded as no more than sufficient for working stocks.

In a survey prepared for WORLD PETROLEUM and published in the issue of September, 1946, demand for oil in the United States during the current year was estimated at 4,875,000 barrels daily or 1,780 million barrels for the year. The average increase forecast for all products is 6.5 percent, but in the case of gasoline the expected rise is put at 9.0 percent in view of the larger anticipated output of motor vehicles. As the estimated consumption of gasoline during the past year was roundly 600 million barrels, this would be an increase of 54 million barrels for this product.

As a result of the attention that has been directed to the Middle East, the vast extent of its estimated reserves and the plans reported for expanding production from that area, fears have been expressed in some quarters that world production may outrun demand, leading to disorganization and destructive competition. In the opinion of leading economists, the danger of such a situation is slight. While production undoubtedly will increase, its growth will be gradual. They hold that in the United States the requirements of consumers are practically certain to keep in advance of the growth in output necessitating a gradual rise in the volume of imports. In Russia, they point out, the broad program for increased production that has been set up contemplates only that it shall satisfy internal needs by the year 1960. In countries other than these two, they estimate a growth of 25 percent in requirements for petroleum products by 1950, a rate of growth that will test the energies of those engaged in finding and processing oil and will fully occupy the facilities of makers of machinery and supplies.

WORLD PRODUCTION

(Thousands of Barrels)

North America	1944	1945	1946
United States	1,678,000	1,712,000	1,732,000
Canada	10,000	8,000	7,500
Mexico	38,000	41,500	42,500
Trinidad	22,000	21,000	21,000
	1,748,000	1,782,500	1,803,000
South America			
Argentina	24,500	23,500	23,000
Colombia	22,500	23,000	23,500
Peru	15,000	14,000	14,500
Venezuela	267,000	323,500	388,500
Other	3,500	3,000	4,500
	332,500	387,000	454,000
Europe			
Austria	(a)	(a)	7,500
Hungary	(a)	(a)	5,000
Romania	26,000	34,000	29,750
U.S.S.R. (b)	175,000	185,000	195,000
Other	27,500	16,000	6,250
	228,500	235,000	243,500
Asia			
Bahrein	7,000	7,500	8,300
Iran	102,000	129,000	144,000
Iraq	29,000	30,000	32,000
Kuwait	—	—	6,200
Netherlands Indies	(a)	(a)	12,000
Saudi Arabia	9,000	21,000	65,000
Other	26,000	16,500	6,400
	173,000	204,000	273,900
Africa			
Egypt	9,000	9,000	9,500
WORLD TOTAL	2,491,000	2,617,500	2,783,900

(a) Included in "Other"
(b) No statistics published; estimates by outside authorities

JERSEY STANDARD DEVELOPS "THIRD ASSET"

THREE principal assets are owned by the Standard Oil Co. (N. J.), the management believes. It has large reserves of crude oil and natural gas in underground reservoirs available for future production as required. It has modern facilities for producing, transporting, manufacturing and marketing petroleum. The third great asset is the people who make up the staff of workers, supervisors and managers. Executives of the Jersey company consider that this third asset is as valuable as the other two and have adopted a program which seeks to increase this value to the company of its 28,000 employees.

Within the past month the company formally opened a training center at Elizabeth, N. J., which is designed to develop long-range training programs and afford company-wide services for group instruction. Here, in a three-story building, a group of 18 instructors are conducting technical, sales and supervisor training courses for selected employees from distant as well as nearby offices and plants.

Budgeted cost of operating the headquarters training center is $400,000 in 1947 and $500,000 in 1948. These sums do not include the money which will be spent in educational work at the plants and offices themselves. In the aggregate the company's educational work outside the Elizabeth center will cost more than the headquarters operation.

In developing the training center, the Army's wartime experience in the use of visual aids to education was heeded carefully. In fact some of the men who have taken a leading part in building and operating the new center were engaged in army training programs. At the formal opening of the center, H. D. Kolb, assistant manager of the training division of the employee relations department, was presented with the Legion of Merit for his work during the war in training 300,000 men in the Army Air Forces. Director of the center is Dennis V. Ward, former director of training of the Army Engineer School and Army Service Forces Training Center at Fort Belvoir, Va.

Visual aids include elaborate murals to depict subsurface conditions in producing fields and the flow of products to markets. Models of catalytic cracking processes, alkylation plants, tube stills, fractionating columns and other principal refining units have been built of glass wherever possible, so that students may trace the flow of materials more readily and understand what takes place. In the case of smaller items such as oil burners, it is possible to have the actual equipment at the center so arranged that it may be disassembled and studied. Laboratory test apparatus is available to illustrate lectures on viscosity and motor knock. A life-size service station complete except for lubrication lifts is used for practical work in developing dealer training programs.

M. J. Rathbone, president of the Standard Oil Co. of New Jersey, explains a cat cracking plant model to R. T. Stoner, Pennsylvania state director of industrial education, and C. R. Dooley of the Training Within Industry Foudation.

Class of employees studying a glass model acid treating system.

Charts, posters and other graphic training aids have been prepared for class work to promote understanding of difficult subjects. Motion pictures and slide films are used.

The company feels that the course called "Basics of Supervision" is the most important now being conducted at the center. The course is designed for men whom the management believes to be good supervisory timber as well as foremen and other supervisors of relatively limited experience. Groups of 15 men are brought to Elizabeth for the course on full pay and at company expense. For two weeks the men study together six hours daily. The conference method is used and, as in all other education work at the center, it is a rule of thumb requirement that some member of the class must take an active part in the proceedings at least every three minutes. The instructor must consider himself as a leader and not as a lecturer.

The supervisor training course is considered highly important just now because so many veterans of enhanced capabilities are returning to the company. They have developed greater abilities during the war and now need industrial training to enable them to forge ahead quickly. Many new foremen were created during the war who did not have an extensive background with the company, and it is considered desirable to give them the advantage of studies in management technique.

There are three general parts to the supervisor training course. The first seeks to create the proper attitude on the part of the foreman or prospective foreman toward both workers and management. It seeks to show the responsibilities of the job and that it is one of ideas instead of tools. Second part of the program is a practical course in the work a supervisor does. It deals with planning work, delegation of jobs, handling of grievances, how to train workers on the job. The third stage deals with company policies regarding new employees, transfers, leaves of absence, vacations, pay rates, accidents, sickness and similar information a foreman should know.

In an address at the opening of the center, M. J. Rathbone, president of Standard Oil of New Jersey, stated that the training program was adopted to "increase the capacity of our people to produce because therein lies the way to higher production and lower costs."

The Elizabeth plant is but one phase of the company's training plan which, at the highest level, involves the training of managers in the executive development program. In this latter project it is the aim to have a backlog of competent men available for any job which may become open in the executive ranks. The executive training program involves job rotation to give promising young men a broad knowledge of company operations.

SENATE COMMITTEE STRESSES FUTURE ROLE OF SYNTHETICS

FINAL report of the special Senate Committee Investigating Petroleum Resources, more commonly referred to as the O'Mahoney Committee, which was made public last month, makes specific recommendations for assuring future supplies of petroleum adequate to the country's needs. These include the encouragement of domestic exploration and promotion of the full development of world resources for the benefit of all peoples. Perusal of the report indicates, however, that the committee holds that for the United States the real answer to the problem of future supply lies in the development of synthetic fuels rather than in dependence upon foreign deposits of the natural product.

Emphasizing that Americans are sincerely dedicated to the establishment of world peace, it points out that until such international understanding is attained, the United States "must, under no circumstances, abandon to chance" its industrial and military capacity to uphold its ideals.

As the committee sees the problem, the nation now faces this alternative: (1) To await with hope the discovery of sufficient petroleum within its own borders so that the military requirements of the future will occasion no concern, and in the meantime to depend upon foreign oil and trust that war will not cut off imports, or (2) To take steps to guarantee a domestic petroleum supply adequate for all eventualities by means of incentives to promote the search for new deposits of petroleum within the boundaries of the United States and of the Continental Shelf, and by continuance of the present program looking to the production of synthetic liquid fuels to supplement its domestic crude supply.

"All the facts before us," says the committee, "impel the choice of the second alternative. Therefore, the first principle of American petroleum policy should be to sustain our domestic supply of petroleum and to maintain the American system of competitive free enterprise at home and abroad. The second principle is to make human freedom the cornerstone of our policy, to strive for the advancement everywhere of liberty and opportunity for people without discrimination or restraint, both within and beyond our borders."

To these ends we should: (1) Enact laws conducive to stimulating additional exploration and development in the United States. Encourage conservation to prevent waste. Promote interstate compacts so that reserves may be expanded and used in the public interest, but guard against misusing conservation laws to restrain operators unduly. Administer the public lands, not primarily as a source of governmental revenue, but for the purpose of stimulating private initiative in discovering and developing oil on the public domain.

(2) Utilize the facilities of government to promote research in the manufacture of synthetic liquid fuels, but without permitting governmental competition with private industry. Enact legislation to encourage secondary recovery from oil fields which otherwise would not be productive.

(3) Encourage free competitive enterprise by tax reforms to provide incentives for the risk of private capital in new ventures. Maintain the atmosphere in which competition may survive by enforcement of the anti-trust laws. Adhere to the federal statute prohibiting interstate shipments of petroleum produced in violation of state law. Continue the provisions of the income-tax law permitting deductions for depletion and intangible drilling costs.

(4) Require full disclosure to the appropriate agency of government of the principal terms, conditions and obligations by which American companies undertake to carry on the petroleum industry abroad.

(5) Follow a foreign policy designed to promote full development of the petroleum resources of the whole world for the benefit of all peoples; to secure adequate supplies of petroleum and to discourage artificial restraints and restrictions, both political and private, which deny full opportunity for the people of all lands to participate beneficially in the production of petroleum and petroleum products.

The Committee pointed out that new sources of petroleum in the United States might be obtained, "but to what extent no one can say with any degree of certainty," by new exploratory drilling on the public domain; by deeper drilling, as a result of improved technology, to horizons hitherto untested; by stimulating production from old fields by improved methods of secondary recovery and by payment of governmental subsidies; by exploration of the Continental Shelf; by manufacture of gasoline and other products from natural gas, and by extraction of petroleum from oil shale and manufacture of synthetic liquid fuel from coal or possibly from agricultural commodities.

"However sanguine may be the hopes of geologists derived from historical trends of discovery," say the investigators, "or however likely may be the presence of petroleum in untested areas, it would be unwise to rest conclusions for present purposes upon any premise other than 'proved' reserves as that adjective is understood by the American oil industry. If present estimates of future productive possibilities are later demonstrated to have been conservative, our national oil policy could be readily adapted to the happy plenitude of supply. If the future proves less roseate, our policy will have run concurrently with the facts, and the nation's security will not have been adventured."

If another war comes and is waged wholly or partly outside our boundaries, the committee says, the availability of oil from American reserves near the foreign theatre of hostilities would be advantageous. To the extent that the war might be waged within or near the continental United States, the reserves within this country would be of paramount importance.

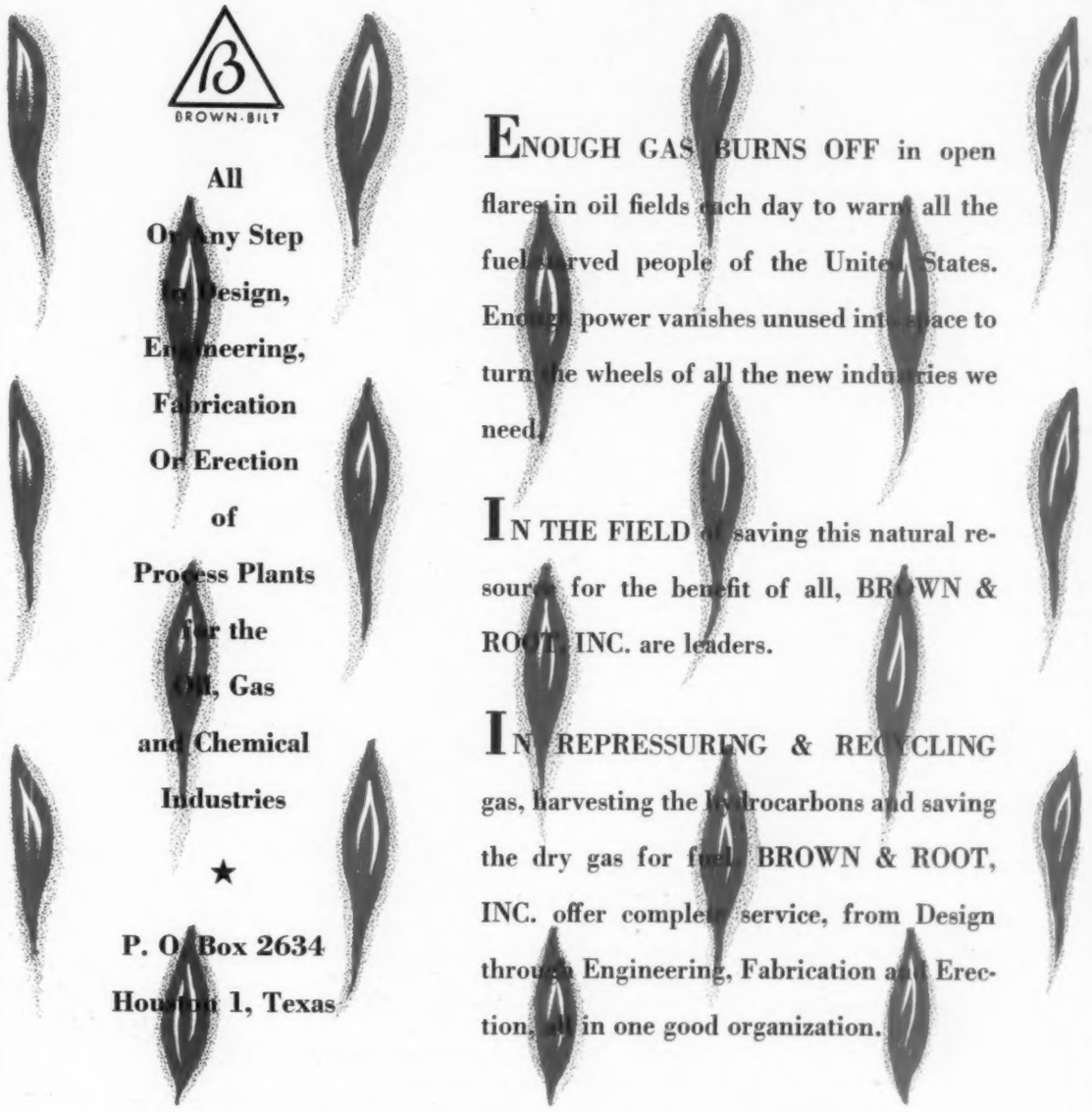
If called on to supply all its military and civilian requirements from at home, the task could not be accomplished from the reserves now known, the committee says. The United States no longer enjoys the comfortable margin between production and productive capacity prevailing in 1941, it points out.

To say that imports from the Caribbean area can be utilized in wartime by virtue of our control of intervening waters is too hazardous a program. Our naval bases and tankers are subject to destruction, to say nothing of the possibility of attack on the foreign petroleum fields themselves.

"The answer," the committee concludes, "is to be found in synthetic production. Synthetic gasoline can be produced from natural gas at costs similar to present costs of producing domestic gasoline from crude petroleum. Oil shale and sub-bituminous coal and lignites also can be utilized to produce gasoline and other liquid fuels at a cost which research has already reduced from 14 to about eight cents per gallon above that of producing gasoline from crude. These sources of supply, it is estimated, are capable of meeting all domestic petroleum requirements for many centuries. In view of these facts it is folly to be apprehensive that this nation is facing a shortage of liquid fuel. But it behooves the nation as soon as possible to take bold steps in the direction of synthetic production so that such production can become readily geared into the oil economy."

The committee feels that too little is understood as to the place that American oil companies operating in foreign fields occupy in our modern economy. Practically, the committee finds, all oil imported into the United States is produced by American companies. The United States treasury also receives large sums in duties and income taxes arising from these foreign operations. The purchase in this country of drilling machines, pipe lines and refining equipment for foreign installation involves an annual expenditure of many millions of dollars. Moreover the enlarged purchasing power of countries which benefit economically from the development of oil production by American enterprise is reflected in an increased demand for other goods including exports from the United States.

NO ONE NEED EVER BE COLD



BROWN-BILT

All
Or any Step
in Design,
Engineering,
Fabrication
Or Erection
of
Process Plants
for the
Oil, Gas
and Chemical
Industries

★

P. O. Box 2634
Houston 1, Texas

ENOUGH GAS BURNS OFF in open flares in oil fields each day to warm all the fuel starved people of the United States. Enough power vanishes unused into space to turn the wheels of all the new industries we need.

IN THE FIELD of saving this natural resource for the benefit of all, BROWN & ROOT, INC. are leaders.

IN REPRESSURING & RECYCLING gas, harvesting the hydrocarbons and saving the dry gas for fuel, BROWN & ROOT, INC. offer complete service, from Design through Engineering, Fabrication and Erection, all in one good organization.

BROWN & ROOT, INC.

SECRETARY KRUG DISCUSSES FUTURE SUPPLIES

By William J. Maddox
Chief, World Petroleum's Washington Bureau

POINTING out to Congress that our current rate of petroleum discoveries in new pools is only about half of our rate of use, Secretary of the Interior Krug says in his annual report that "we are living largely" on past discoveries and "the hope that there will be more, although we know that the rate of discovery has been going down." Our proved reserves, he states, are estimated at about 21 billion barrels, while in 1945 we used up 1.7 billion barrels, and peacetime expectations are for an even greater demand in the years ahead.

The mineral and conservation agencies of Interior see their first job in this field as that of helping to find more oil, gas and coking coal, and to obtain better recovery from the resources that have been found. But the work of discovery has become more expensive and difficult, he reported. Geophysical instruments of various types have to be used over wide areas and with rigorous accuracy, and their evidence must be interpreted from a wide and "imaginative" geological background.

"The areas that seemed possibilities," he says, "certainly those with outcroppings or obvious favorable surface evidence of favorable structures, have already been examined and drilled. Among the great remaining hopes are two—discovery of stratigraphic trap oil pools and salt domes on the continental shelf under water adjacent to oil-bearing regions, in the Gulf of Mexico, Coast States and existing fields in California. There is considerable optimistic opinion among geologists that we may hope to find about as much oil in the future as we have in the past, in the range of 50 billion barrels, but it may cost much more to find and produce than it has cost up to now."

Exploration in the western states is particularly important, his report points out. Several ways of increasing our oil reserves are mentioned in addition to discovery of new pools. One of these is secondary recovery of oil left in the ground after the original pressure has been exhausted. We know, the Secretary says, that there are several billion barrels of oil remaining in our older fields which were not recovered during the primary steps of production.

The third approach, he says, is through a synthetic fuels program which will bring down the costs of producing oil from coal, oil-shale and asphaltic sands, to a place where it would be reasonably competitive with natural petroleum. He expressed the belief that if decline in the supply of petroleum is not postponed by a very considerable improvement in the rate of discovery, and we have to go the synthetic route, a considerable geographical dislocation and relocation can be expected to take place, affecting employment, population movements and investments. He figures that if we can get the equivalent of as much as one billion barrels of oil out of coal, at the rate of one ton of oil from every four tons of coal, a coal production of roughly 572 million tons would have to be added to our present annual production of about 550 million tons. That production would probably have to come from the areas where strip mining is possible and costs are lowest.

As to costs, the Bureau of Mines' best estimates of the cost of oil production are, assuming $1 per ton for strip-mined coal and $.50 per ton for oil shale: From coal, $3 to $4 per barrel (unrefined), and from oil shale, $2 to $2.50 per barrel (unrefined).

Krug makes the suggestion that the "equivalent of replenishment of our reserves" may be secured in part by importations of oil. From the conservation viewpoint, he says, the extent to which we can produce oil without causing physical waste is a prime factor in measuring our needs for oil from outside sources. Late in the war period we were forced to overproduce our fields by about 300,000 barrels a day in order to meet military and essential civilian needs. For a short period, he says we lost the benefits of well-organized production that we had gained through conservation in the 1930's after it had come to be recognized that over-production was destroying the resource base as well as ruining the participants in the industry.

"Foreign supplies must be geared to the situation of the domestic oil industry as well as to the needs of the rest of the nation's industries and homes," Krug declares. "The need for such foreign supplies is obviously of a different order of magnitude today when we are using substantially all of our efficient productive capacity."

During 1946 air-borne magnetometer surveys covering about 70,000 square miles were made by the Geological Survey in cooperation with the Office of Naval Petroleum and Oil Shale Reserves. The surveys were made over potential oil-producing areas in nothern Alaska, Wyoming, New Mexico and the coast of the Gulf of Mexico, and over magnetic iron regions in the Adirondacks. The instrument has been modified, and field methods have been improved, so that large areas can now be surveyed more rapidly and more accurately than by ground magnetic methods; the air-borne method is said to be 50 to 500 times faster and provides detailed data.

The Bureau of Mines says that probably the greatest contribution of geophysical work during the fiscal year ending in Mid-1946 was the exploration of the continental shelf. With a considerable degree of certainty, it says, preliminary Bureau studies indicate that there is a large potential oil reserve in the shelf in the Gulf of Mexico and that there is a probable large potential reserve of oil on the Arctic Coast and the Western coast of the United States.

As a result of its research work in the field, the Bureau of Mines places the costs of producing gasoline from coal and shale at from 7.5 to 9.5 cents a gallon, a few cents higher than the cost of gasoline from petroleum. Oustanding scientific and engineering achievements, resulting in improved processes, suggest material reductions in costs. Core drilling in the Western Colorado oil shale area in the last year reveals much more oil than previously was estimated. The field will run some 300,000,000 barrels of oil per square mile, or a total of 15,000,000,000 barrels in this area alone.

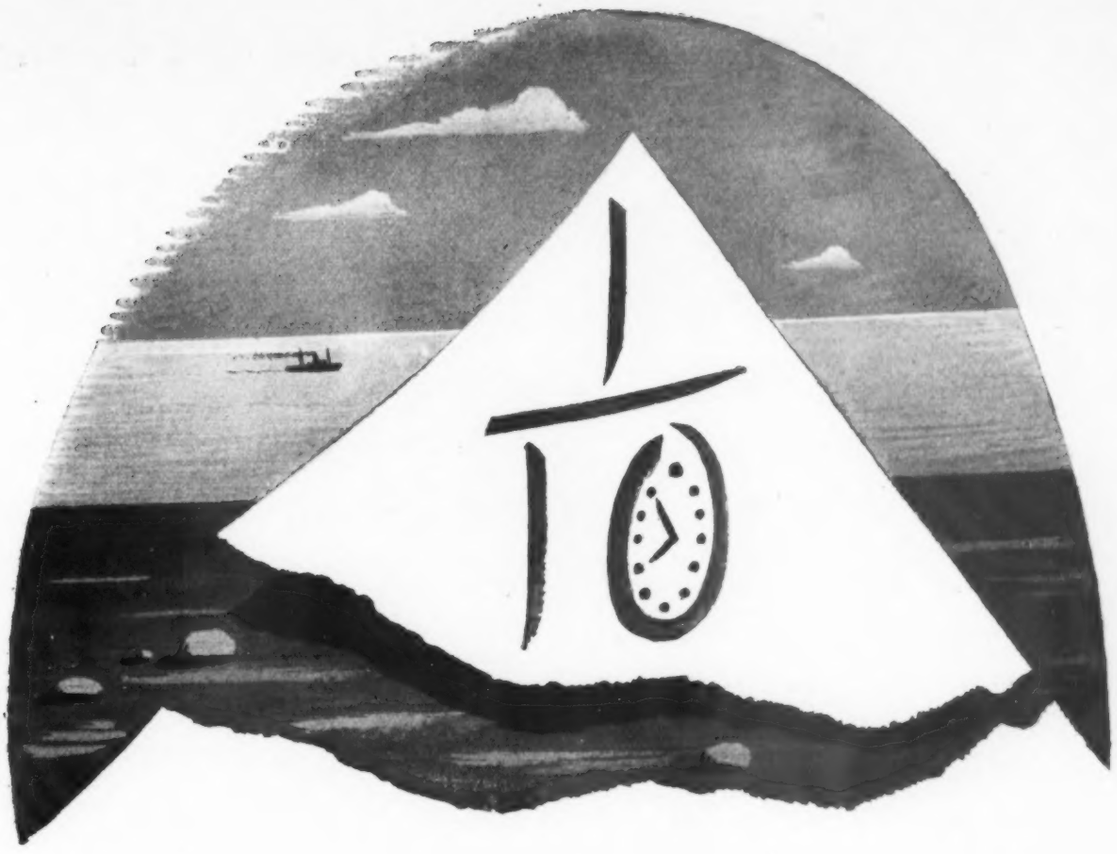
Approval by the API of the Anglo-American oil pact, which has been gathering dust in the Senate Foreign Relations Committee, has raised expectations of its approval by the Senate. At last hearings have been scheduled for the treaty, and indications are it will get a favorable report from the committee.

In a letter to API President William R. Boyd, Jr., Under Secretary of State Will Clayton stated unequivocally that the pending agreement provided no basis for the fear that ratification would result in large importations of foreign oil into the United States. The letter further explained that the international petroleum commission contemplated by the Anglo-American Oil Agreement is consultative and advisory only and that it has no executive authority, nor power to regulate or control either foreign or domestic operations, or to revise existing contracts or concessions.

"The State Department," Clayton declared, "has no policy or program which contemplates the creation of a petroleum regulatory body, and the pending Anglo-American Oil Agreement will provide neither a basis for the government regulation of the domestic or foreign petroleum industry nor for an extension of governmental powers with respect to the industry."

Under Secretary of the Interior Oscar Chapman, talking before the NPC at its January meeting,

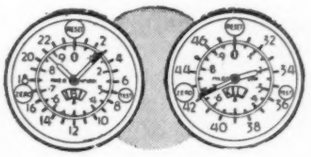
(Continued on page 110)



cutting survey time to a fraction

How long will it take to map the new area ? With the Decca Navigator in use, previously estimated surveying time can be cut to a fraction. Vast areas of land or sea can be mapped to a degree of accuracy and at a time-cost so low as to revolutionize the whole practice of surveying. Areas previously inaccessible come easily within the scope of economical survey.

The Decca Navigator is the latest development of radio science for survey work. Extremely simple to operate and working from an easily erected transportable transmitting station it gives a *continuous fix* of position on direct reading dials for boat, 'plane or mobile party. For highly accurate survey in a tenth of the time, choose the Decca Navigator.



The Decca Survey Department will gladly quote you for a Navigator equipment to suit your specific needs if you will tell them the nature of your business and the areas you propose to survey. If required, a Decca Engineer will be sent to discuss the matter with you. No obligation will be incurred.

The Decca Navigator Company, Limited

Survey Department 1-3 Brixton Road, London, S.W.9 England

telephone: Reliance 3311 *telegrams and cables:* Decnav, London

International News and Notes

Dr. Virgilio Penso de Leon

Transamerican in Venezuela

Dr. Virgilio Penso de Leon has been appointed Venezuelan representative of Transamerican Factors, Ltd., according to an announcement by Victor E. Milch of Los Angeles, resident partner in the United States. Venezuelan offices will be at "El Conde" Este 10, No. 162, Caracas.

Dr. Penso formerly was chief inspector in the Maracaibo basin for the Venezuela ministry of petroleum. In that position he became well acquainted with oil men of the region and added to his practical and technical background. On a recent visit to the United States, Dr. Penso inspected various factories manufacturing equipment handled by Transamerican Factors, including the complete procedure of preparing and using "Black Magic" oil base drilling mud.

Consumption in Brazil

An unofficial estimate of the consumption of petroleum products in Brazil during the twelve months of 1946 places the total at 16,350,000 barrels in round figures, made up as follows:

Product	Barrels
Gasoline	6,000,000
Aviation gasoline	550,000
Kerosene	1,000,000
Diesel oil	1,500,000
Fuel oil	6,900,000
Lubricating oil	400,000
Total	16,350,000

Portable Rig Built for French

The largest truck-mounted drilling rig ever built has just been completed by Franks Manufacturing Corporation of Tulsa, for delivery to Regie Autonome des Petroles, St. Gaudens, Hte Garonne, France. The giant rig is to be used for remedial work in gas-producing areas of southern France.

The rig is mounted on an all-wheel drive truck which is over 45 feet in length. It includes drawworks, two-engine power plant, two slush pumps, propeller shaft rotary table, and a 90 ft., 200,000 lb. capacity telescoping derrick. The truck and auxiliary engines, both of which are diesels, will produce in excess of 350 horsepower.

Lt. Gen. Sir W. G. Lindsell

Joins Manchester Directorate

Lieut. General Sir Wilfrid Gordon Lindsell has been elected a member of the board of directors of Manchester Oil Refinery Ltd. He also is a director of Petrocarbon, Ltd., and Petro-Chemicals, Ltd., companies closely associated with the Manchester refinery. These latter companies plan to build a plant for the production of chemicals from petroleum raw materials.

General Lindsell is a veteran of two world wars. He served in France in 1914-1918 and in France, the Middle East and India during the second world war from 1939 to 1945. Since his retirement in 1945 after 42 years military service, he organized the disposal of government stores under the Board of Trade in 1946. General Lindsell is the holder of numerous awards from Britain for service and has been decorated also by France and the United States.

Visit Failing Factory

Sir William Stampe of New Delhi, India, and a group of other Britons recently visited the George E. Failing Supply Company factory at Enid, Oklahoma to study the manufacture and operation of Failing portable drilling equipment. In the party with Sir William were A. S. Wade of Washington, D. C., member of the English Supply Mission; E. M. Fones of the Mitchell Engineering Company of London; and John B. Weil, Failing agency representative in Johannesburg, South Africa. They were accompanied by G. P. Gregory, Jr., New York City, Failing export manager.

M. M. Stuckey Dead

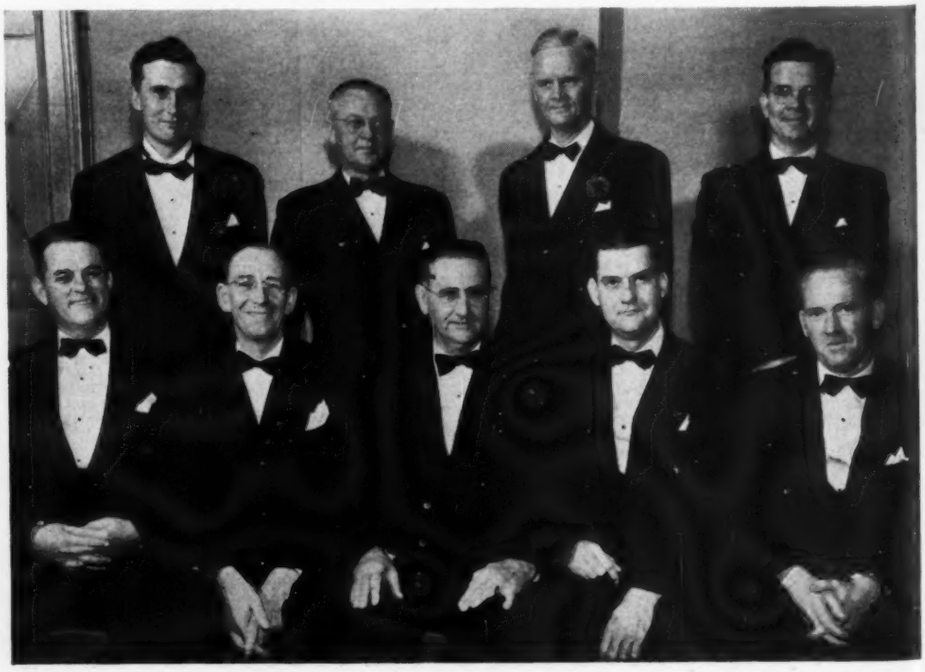
M. M. Stuckey, general manager of Iraq Petroleum Company in the Near East and a prominent figure in the international oil industry, died January 23 at Haifa, Palestine, and in accordance with instructions in his will, was buried at sea. Mr. Stuckey was born at Carthage, Mo., in 1887 and was engaged in oil work in the United States and South America prior to 1931, when he went to the Near East to direct the construction of the Iraq pipe line. He had remained with the Iraq Petroleum Company since that time, first as assistant manager and later as manager.

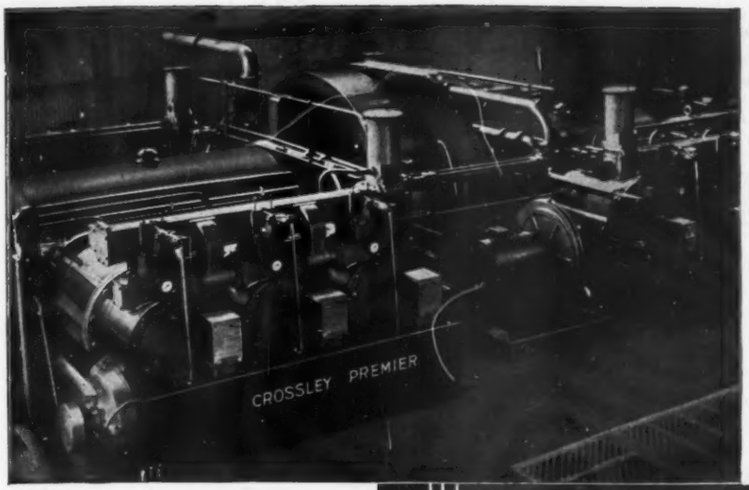
Houston Nomads Elect Officers

Officers of the Houston Chapter of Nomads to serve during the year 1947 were installed at a recent dinner dance at the Rice Hotel. Nearly 500 Nomads and their guests attended. During the evening the retiring president, Charles W. Thornhill, was presented with a gift in silver as a token of appreciation for his work during the past year.

The new officers, shown in the picture below, are left to right as follows: Seated; Chas. E. Richards, Gray Tool Company, president; Geo. E. Tyson, J & L Supply Company, vice president; C. L. Clausel, A-1 Bit & Tool Company, sec'y-treas.; H. J. Wood, Lebanon Steel Foundry, asst. sec'y-treas.; Jack Barnes, Trinity Portland Cement Co., sergeant-at-arms.

Standing: Edwin Ross, Baash-Ross Tool Co., deputy sergeant-at-arms; Floyd L. Senter, National Tank Company, regent; Chas. W. Thornhill, Thornhill-Craver Co., past pres. and regent; Harry E. Estes, Reed Roller Bit Co., executive secretary.





1,800 B H P vis-a-vis Gas Engine operating on natural gas. A Trinidad Oilfields Installation.

POWER
BY
CROSSLEY
-PREMIER

UP TO 4000 BHP

RELIABLE ECONOMICAL
ACCESSIBLE SIMPLE

CROSSLEY-PREMIER ENGINES LTD

SANDIACRE, Nr. NOTTINGHAM

P65

London Office: Langham House, 308, Regent Street, W.1.

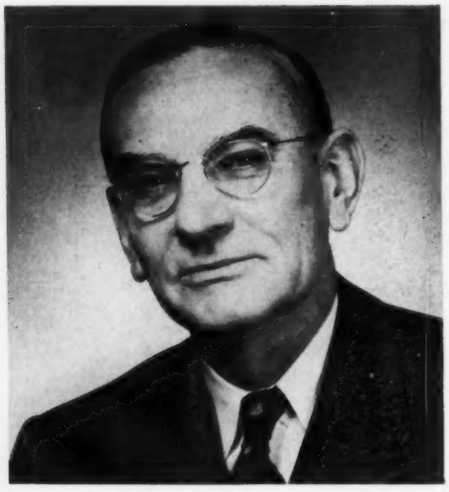
RECORD
REGD TRADE MARK
PIPE TOOLS

USED IN OILFIELDS ALL OVER THE WORLD
ALL PARTS INTERCHANGEABLE WITH STANDARD AMERICAN MAKES.

MANUFACTURERS
C. & J. HAMPTON LTD. · SHEFFIELD · ENGLAND

OIL COMPANY STAFF CHANGES

Albert E. Van Dusen



J. E. Norton

ALBERT E. VAN DUSEN, formerly general attorney of The Texas Company, has been appointed general counsel of California Texas Oil Company, Limited, and its affiliated companies. Mr. Van Dusen was admitted to the bar in 1927 and practiced law for a short time in New York before joining the legal staff of The Texas Company.

Caltex, a joint interest of Standard of California and The Texas Company, recently purchased the European and North African subsidiaries of The Texas Company. It is now engaged in marketing petroleum products throughout a substantial portion of the world.

W. L. LAUFMAN has been elected president of the Fleet-Wing Corporation, a subsidiary of The Standard Oil Company of Ohio which markets petroleum products through independent jobbers in 10 states. Mr. Loufman became associated with the Transcontinental Oil Company immediately after World War I, and when only 25 years of age was sent to Romania in charge of the company's producing activities there. When the operation was discontinued because of difficulty with the Romanian government, he returned to develop an export sales department for Transcontinental. He later became sales manager, and when the eastern properties were sold, he became vice president of Republic Oil Company where he pioneered the sale of Ethyl gasoline. He has been with the Fleet-Wing Corporation since it was organized.

THE APPOINTMENTS of Oscar B. Lewis as assistant sales manager and E. Oliver Jones as manager of customer services are announced by Julian J. Frey, general sales manager of Ethyl Corporation. Mr. Lewis, who has been manager of safety for the past 12 years, joined Ethyl twenty years ago. Mr. Jones, whose work as head of customer services will include the direction of safety programs, came to Ethyl in 1932 and served for the most part as a safety engineer until he was called to Washington as a member of the staff of the Petroleum Administration for War. After two years with the PAW he returned to Ethyl as a special assistant to the general sales manager.

J. E. NORTON has been appointed to the newly-created position of coordinator of personnel development of Standard Oil Co. of California. He will assist in the selection, placement, training, appraisal and recognition of key personnel in the company. Norton has been with Standard for 40 years. He became assistant comptroller in 1939.

PHILIP A. LESTER, retiring from his position as fuel oil representative for the Shell Oil Company in New Orleans, was honored at a dinner party attended by shipping officials and friends in the fuel oil field. He began work with the National Petroleum Corp. in New Orleans and later became a Shell bunker fuel salesman. Mr. Lester will be succeeded by A. D. Penniman who has been his assistant for the past 11 years.

RUSSELL B. WESTON has been made advertising manager of Ethyl Corporation. Mr. Weston joined Ethyl nearly 20 years ago as a field representative and has served in nearly every phase of sales department activities, including the duties of sales promotion manager and assistant advertising manager.

Russell B. Weston

JOHN B. DUCKWORTH has been made an assistant director of research of Standard Oil Company (Indiana). He has been a member of the research department since 1936, except for four years in military service with the power plant section of the Air Technical Service Command at Wright Field, Dayton, Ohio.

At Standard's Whiting research laboratories, F. S. Wood has been promoted to lubricants group leader of the engine laboratory; E. L. Gregory has become mechanical supervisor in the engine laboratory; and Dr. J. C. Bailie has been advanced to assistant chief chemist.

MAX M. ROENSCH has joined the Ethyl Corporation as a member of the engineering department of the research laboratories in Detroit. As one of the three coordinators on the staff of J. B. Macauley, director of engineering research, Mr. Roensch will be responsible for research and development pertaining to the power, economy and durability of engines. He formerly was with the Chrysler Corporation engineering laboratories and more recently was chief engineer of the Cleveland Graphite Bronze Company.

JAMES TANHAM, vice president of The Texas Company, has been appointed by President Truman as an industry delegate to the International Labor Office's petroleum industry committee which met in Los Angeles early in February. The committee is one of eight such groups recently established by the I.L.O., which is an official adjunct of the United Nations. The delegates represent government, labor and management from each of twelve petroleum-producing countries. Mr. Tanham recently attended the I.L.O. conference in Montreal as adviser to the industry delegate.

JOHN L. LENKER, who has been directing retail merchandising and training for Gulf Oil Corporation, has been promoted to assistant manager of the New York sales division. He will be in charge of automotive sales activities in New York, Connecticut and northern New Jersey.

DR. RICHART N. MEINERT, for the past 10 years engaged in research work for Standard Oil Development Company at Bayway, N. J., has been named assistant chief of research for The Carter Oil Company at its Tulsa laboratories. Previously he was a member of the faculty of Brown University.

Dr. Richard Meinert

MORE THAN MEETS THE EYE
Since Franks introduced portable and self-propelled drilling rigs, 100% mounted on self-propelled vehicles, many manufacturers have followed the trend of making "slim-hole" portable rigs for slim-hole drilling. Therefore, there are many many portable rigs which do a creditable job. It is difficult to select the best by just looking at them. There's more than meets the eye. That's why Franks urges you to take an "X-RAY" look into all phases of drilling by which rigs are compared by major oil companies who keep dollars and cents costs records. Look at rig-up and tear-down time; percentage of trouble free operation per foot drilled; fuel and water costs; profitable working life of the rig; over all well-to-well cost per foot; THE ULTIMATE, NOT THE INITIAL COST.
See a Franks representative or write us the depths and requirements and we will send you literature of the Franks rig best suited for your work.
FRANKS REPRESENTATIVES
Main Offices: Box 3216, Tulsa 1, Oklahoma
FRANKS MFG. CORP.
WELL SERVICING AND DRILLING UNITS

Nicholas A. D'Arcy, Jr.

D'Arcy Establishes Agency

Nicholas A. D'Arcy, Jr., well-known California engineer who has been active in the oil industry since 1929, has established an office at Huntington Park as representative of equipment manufacturers. He has been appointed Pacific Coast representative of Fawick Airflex Company, manufacturer of Airflex clutches, and of Torcon Corporation, makers of Torcon hydraulic torque converters.

D'Arcy is a member of AIME, ASME and API. He has been active in these organizations and is the author of numerous technical papers and magazine articles. He received his technical training at California Institute of Technology.

Cadman Medal To Russell

Robert P. Russell, president of Standard Oil Development Corporation, has been selected by the Institute of Petroleum to receive the 1947 award of the Cadman memorial medal. The medal will be conferred in London on June 4 when Mr. Russell will deliver the Cadman memorial lecture, taking as his subject, "Progress in Petroleum Research." The first of the annual Cadman medals was conferred in 1946 on Sir William Fraser, successor to Lord Cadman as chairman of Anglo-Iranian Oil Company Ltd.

Heads Tank Company

S. P. Wallace has been elected president and treasurer of the Maloney-Crawford Tank and Manufacturing Company of Tulsa, succeeding the late Harold D. Crawford who died last May. Wallace was for many years with the Parkersburg Rig and Reel Company and recently has been vice president and sales manager of Maloney-Crawford.

Field Committee Organization

Organization and functioning of oil field engineering committees is the subject of a booklet just released by the Interstate Oil Compact Commission, Oklahoma City, Okla. The publication contains report of a subcommittee of the Commission's Legal Committee, appointed to study the subject of oil field engineering committees and draft provisions suitable for use in their organization. Included also are organization agreements of eleven engineering committees.

Frank John

Named Assistant to President

Frank John has been appointed assistant to the president and director of purchases for Mid-Continent Supply Co., Fort Worth. Mr. John has been with Mid-Continent since 1931 when he was employed as store manager at Kilgore, Texas. In 1933 he was transferred to Fort Worth as purchasing agent. He will continue to direct purchases in addition to directing company policies.

Export Representative Appointed

Roland E. Smith has been appointed representative for Hi-Perm, an oil well cleaning chemical, as announced by J. Paul Sievers, president, Atlas Production, Inc. Mr. Smith will be assisted by Knight C. Templeton. A trip of approximately four months' duration to all the oil-producing countries of South and Central America is planned by Mr. Smith.

Sun Buys Tanker

Sun Oil Company has accepted delivery from the U. S. Maritime Commission of the MS Brandywine, an 18,000 deadweight ton tanker built at Sun Shipbuilding and Dry Dock Company and operated by Sun during the war. The ship has been renamed the MS Atlantic Sun. It is the third of three tankers recently purchased to restore Sun's tanker fleet to full prewar strength of 17 ships with 249,740 deadweight tons. The Atlantic Sun replaces a ship of that name destroyed by enemy action during the war.

Shell Oil Opens School

Shell Oil Company, Inc., has begun a series of training courses for sales supervisory personnel at Idlewild Inn in Katonah, N. Y. The school will utilize all the newest techniques in visual instruction to train several hundred sales employees annually, in a series of three-week classes, each attended by approximately 50 people from various parts of the country. The school will teach such subjects as oil geology, petroleum chemistry, product application, and the economics of marketing. Dr. G. P. Koch will be the educational director.

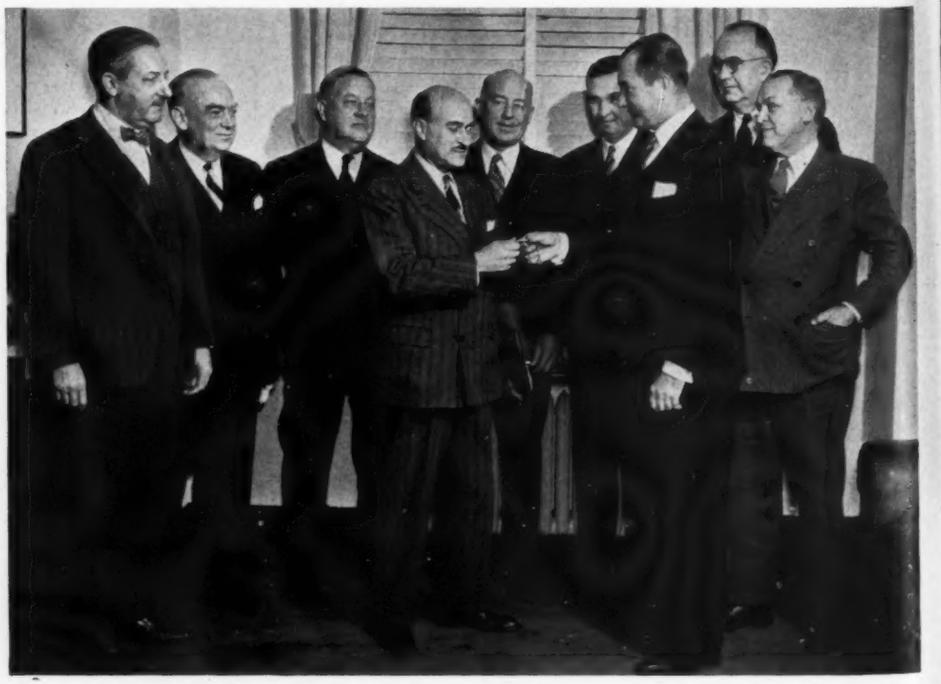
Issues Engineering Booklet

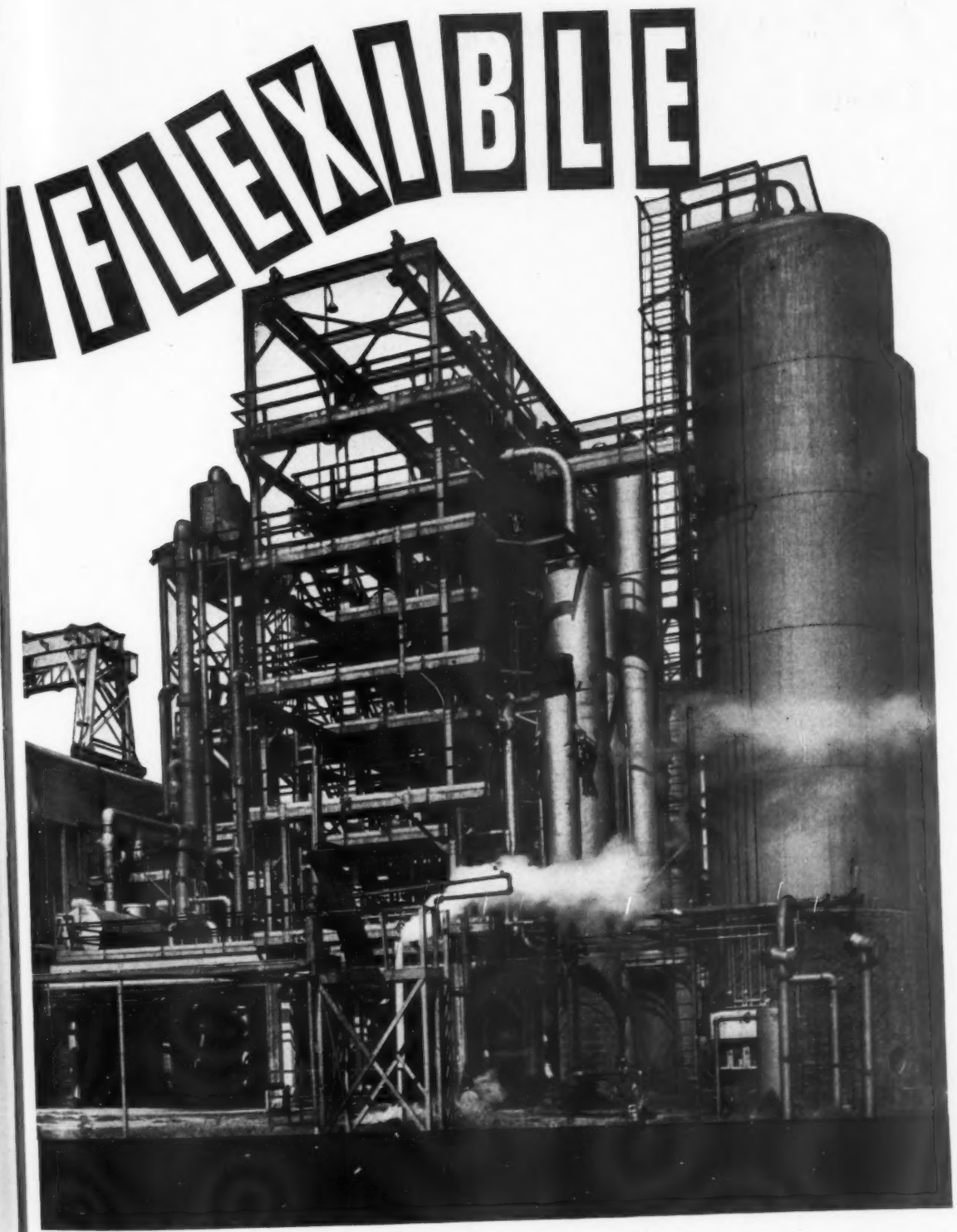
Organization and functioning of oil field engineering committees is the subject of a booklet just released by the Interstate Oil Compact Commission. The publication contains report of a subcommittee of the Commission's legal committee, appointed to study the subject of oil field engineering committees and draft provisions suitable for use in their organization.

Murray Appointed Commissioner

Governor Beauford Jester has appointed William J. Murray Jr. as his successor on the Texas Railroad Commission.

When Laurence B. Levi retired from the Socony-Vacuum Oil Company recently, after 48 years of service, his associates on the Foreign Trade Committee, of which Mr. Levi was chairman, presented him with a wristwatch. Left to right: M. J. A. Bertin, C. T. Crawford, L. A. Blumenthal, Mr. Levi, R. S. Homet, O. J. Bellis (secretary to the Foreign Trade Committee), F. E. Powell, Jr., L. R. Owen and F. H. Henry.




FLEXIBLE

COLOMBIAN OIL NEWS DIGEST
&
COLOMBIAN WILDCAT NEWS
AIRMAILED WEEKLY

✦

COVERS POLITICAL, ECONOMIC & OIL DEVELOPMENTS IN COLOMBIA

6TH YEAR OF PUBLICATION
WRITE FOR SAMPLE COPY

✦

COLOMBIAN OIL STATISTICS
MONTHLY REPORT COVERING

Production, Exports, Refining, Consumption, Imports, Exploration, Drilling, Labor, Financials, Taxes, Imports of oil equipment.

✦

E. OSPINA-RACINES, PUBLISHER
Apartado 27-28 Bogota, Colombia

★ ★ ★

Horace Sanders

Cooper-Bessemer Promotes Horace Sanders

Horace Sanders has been promoted to assistant southwestern district manager for The Cooper-Bessemer Corporation. He has been associated with Cooper-Bessemer for nearly twenty years at Shreveport and Dallas.

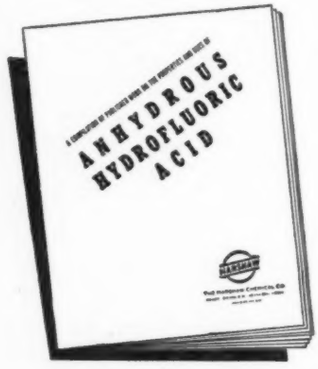
Mr. Sanders is a past president of the Petroleum Engineers Club of Dallas and a member of the Petroleum Engineers Club of Fort Worth. In his new capacity he will assist A. A. Burrell, southwestern district manager, in the administration of Cooper-Bessemer sales and service in that area.

States Objectives and Principles

The Public Relations Operating Committee of the American Petroleum Institute has adopted a written statement of the objectives and principles of operations as a guide to the industry's public relations program authorized at the 1946 annual API meeting at Chicago. District organizing committees now are being set up and will be succeeded later by permanent district committees. Following is a statement of objectives and principles as drafted:

Objectives: To further understanding of the oil business and the people who work in this progressive industry. To make more friends for the oil industry. To advance the common interest of all oil men in maintaining a free, competitive industry to serve the public. Specific immediate objectives are to raise the level of understanding on how the public benefits from—(1) The oil industry's constant and extensive research and its progressive development of improved and new products; (2) large number and different types of business units engaged in the industry; (3) widespread competition in quality, service and prices.

Principles: To serve the industry as a whole. To overcome the great lack of understanding of the oil industry by interpreting it to the public. This activity will not attempt to deal with industry operating problems. These are the province of individuals, companies, or the appropriate groups or associations. To enlist the interest and help of individuals, companies, groups or associations in every segment of the industry in reaching the objectives. To invite representatives of all segments of the industry to participate. To keep the industry's trade press fully informed in recognition of the important part it plays in furthering understanding.

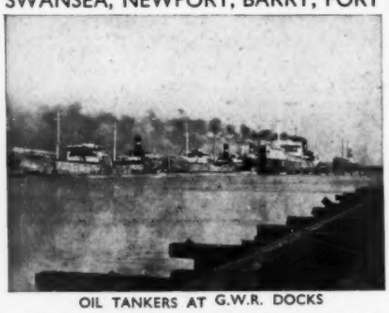


Write for this helpful booklet
You are not obligated

THE HARSHAW CHEMICAL CO.
1945 East 97th Street, Cleveland 6, Ohio
BRANCHES IN PRINCIPAL CITIES

OIL DISTRIBUTION

The Great Western Railway Company's South Wales Docks at CARDIFF, SWANSEA, NEWPORT, BARRY, PORT TALBOT and PENARTH (Harbour) are excellent terminals for oil distribution.



OIL TANKERS AT G.W.R. DOCKS

SITES FOR NEW DEPOTS ARE AVAILABLE

• • • • • •

Information may be obtained from :—

T. D. SLATTERY,
Associated British & Irish Railways Inc.
9, Rockefeller Plaza (16, West 49th Street)
New York, 20,

or direct from :—

LESLIE E. FORD, CHIEF DOCKS MANAGER, GREAT WESTERN RAILWAY, CARDIFF

TOWING . . .
Safe
Swift
Sure

River—Intercoastal Canal—Gulf
EDMUNDSON TOWING CO.
710-A Whitney Building
New Orleans 12, La.
Phone Ma-0409
Phone UP-8075-W

Youngstown to ILLINOIS

ILLINOIS is one of the most active oil regions, even though 1941 saw the end of its greatest drilling boom. It stands high in number of wildcat wells drilled last year, close behind North Texas, the most active wildcatting area of that great oil state.

The oil strength of Illinois lies in its many scattered pools. Proven reserves have increased in the last few years, to more than a third of a billion barrels, which is more crude than is produced annually in Soviet Russia, or all the rest of Europe, or Asia. Ranking eighth among the states in total proven reserves, sixth in 1946 crude production and sixth in all-time production, Illinois will continue as one of America's important petroleum sources for years to come.

Ever since Illinois' oil industry really got under way in 1905, Youngstown has been a major supplier of drill pipe, casing, tubing and line pipe. Operators here, as in every other oil producing area in the world, have learned through experience to recognize the orange bands on Youngstown pipe as the mark of quality and dependability.

Location circled indicates Continental Supply Company store.

YOUNGSTOWN

THE YOUNGSTOWN SHEET AND TUBE COMPANY

GENERAL OFFICES - YOUNGSTOWN 1, OHIO

Export Offices - 500 Fifth Avenue, New York City

Manufacturers of

CARBON - ALLOY AND YOLOY STEELS

Pipe and Tubular Products-Sheets-Plates-Conduit-Bars
Coke Tin Plate-Electrolytic Tin Plate-Rods-Wire-Cold
Drawn Carbon Steel Rounds-Tie Plates and Spikes

Dependable

CORING AND DRILLING EQUIPMENT

wire line and conventional type.
HOLE OPENERS

CATALOGS ON REQUEST

MERCURY OIL TOOL CO.
Incorporated
11320 S. Alameda St., Los Angeles 2, Calif.

Exclusive Export Representatives
TRANSAMERICAN FACTORS LTD.
124 West 6th Street, Los Angeles 14, Calif.

A. H. Jones

Appoints Export Manager

A. H. Jones has been made export manager for Gardner-Denver Company of Quincy, Ill. He has moved to New York where his headquarters will be at 233 Broadway. Mr. Jones has been Los Angeles branch manager for 20 years. He has been succeeded at Los Angeles by George Gutekunst of the Bakersfield, Calif., office.

Drilling Fluid Handbook

Oil Base, Inc., Los Angeles, has issued a 64-page pocket size handbook pertaining to Black Magic oil drilling fluid and conventional clay-water mud covering valuable information in condensed form of formulas for mixing additives, testing procedure, formulas for mud weight and volume increase, conversion factors, pump capacities, drill pipe sizes, capacities of casings, pits and tanks and many tables and charts useful to the man in the field. Much of this information has been compiled for the first time into one complete volume small enough to carry in a shirt pocket. Protected by a waterproof cover, the manual provides blank pages in the book for additional notes. Free copies are available on request by writing to the above, Box 3735 Terminal Annex, Los Angeles 54, Calif.

Sun Oil 1946 Earnings

Sun Oil Company and subsidiaries report for the calendar year 1946 consolidated net income of $14,726,551, after setting aside reserves for depreciation, depletion and federal income taxes. This compares with consolidated net income for the year 1945 of $15,666,543.

After meeting dividend requirements of preferred stock, net earnings in 1946 equaled $4.17 per share, compared with $4.44 per share for 1945.

College Course for Drillers

The Texas Chapter of the American Association of Oil Well Drilling Contractors recently voted to make drilling a science and to establish a school for drillers. Kilgore College in the East Texas field was selected to offer the course. A one-million-dollar laboratory for the study of drilling muds, and other technical problems has been equipped. A rotary rig will be set up on the campus, and each of the twenty-five men now enrolled in the class will be required to operate, maintain and repair any part of the rig.

Sure!

AVONDALE
IS IN THE
OIL
BUSINESS

WRITE FOR DETAILS

. . . and AVONDALE'S new Quick Repair Plant on the Harvey Canal at Harvey, Louisiana is equipped to service and repair any or all of your equipment. Our plant at Westwego, La. specializes in steel fabrication to fit your needs.

AVONDALE
MARINE
WAYS, INC.
Riverfront, New Orleans District Main Plant: Avondale, La.
Telephones: Walnut 8970—Chestnut 2475
Quick Repair Plant—Harvey, La.
Mailing Address: Westwego, La.

Consult CHEMICO
on Acid Production, Recovery, Concentration

Chemico Service is COMPLETE, covering every detail in the design and construction of an acid plant. Over a quarter-century of experience of specialization in this field assures authoritative recommendations and satisfactory results backed by performance guarantees. Consult us without obligation.

CHEMICAL CONSTRUCTION CORPORATION
350 Fifth Ave., New York 1, N. Y.
European Technical Representative:
Cyanamid Products Ltd.
Brettenham House, Lancaster Place,
London W.C. 2, England
Cables: Chemiconst, New York
CC-112

CHEMICO PLANTS are . . .
PROFITABLE INVESTMENTS

JOHN ZINK
Series CBM BURNERS
PERFORM!

1— Reduce bridge wall temperature from 1500 deg. F. to 1150 deg. F. at same charge rate with both fuels.
2— Reduce excess air from 90% to 35%.
3— Provide a marked reduction in fuel burned.
4— Provide possibility for greatly increased volume of material processed.
5— Provide very even distribution of heat with both fuels.

Write for Literature

JOHN ZINK COMPANY
4401 S. Peoria Tulsa, Oklahoma

HERE'S TRUE PORTABILITY IN A GRAVITY METER

GRAVITY surveying is faster, easier and more accurate when field parties use the North American Gravity Meter. Carried by one man on the back pack the Meter can be moved over rough terrain with utmost ease and simplicity. Areas accessible by car can be surveyed from the rear seat of a sedan or jeep in which the Meter is mounted. When working swampland or water areas, it can be moved to location by small boat or canoe.

With a sensitivity of .01 milligal extremely accurate readings are obtained . . . providing reliable data for sound interpretations on which to scientifically approve areas for further exploration.

You are invited to write for full details of our gravity meter lease plan and gravity surveys on contract basis by our own skilled crews.

Gravity-Magnetic-Seismic Surveys
Geophysical Apparatus

NORTH AMERICAN GEOPHYSICAL COMPANY

HOUSTON 6, TEXAS

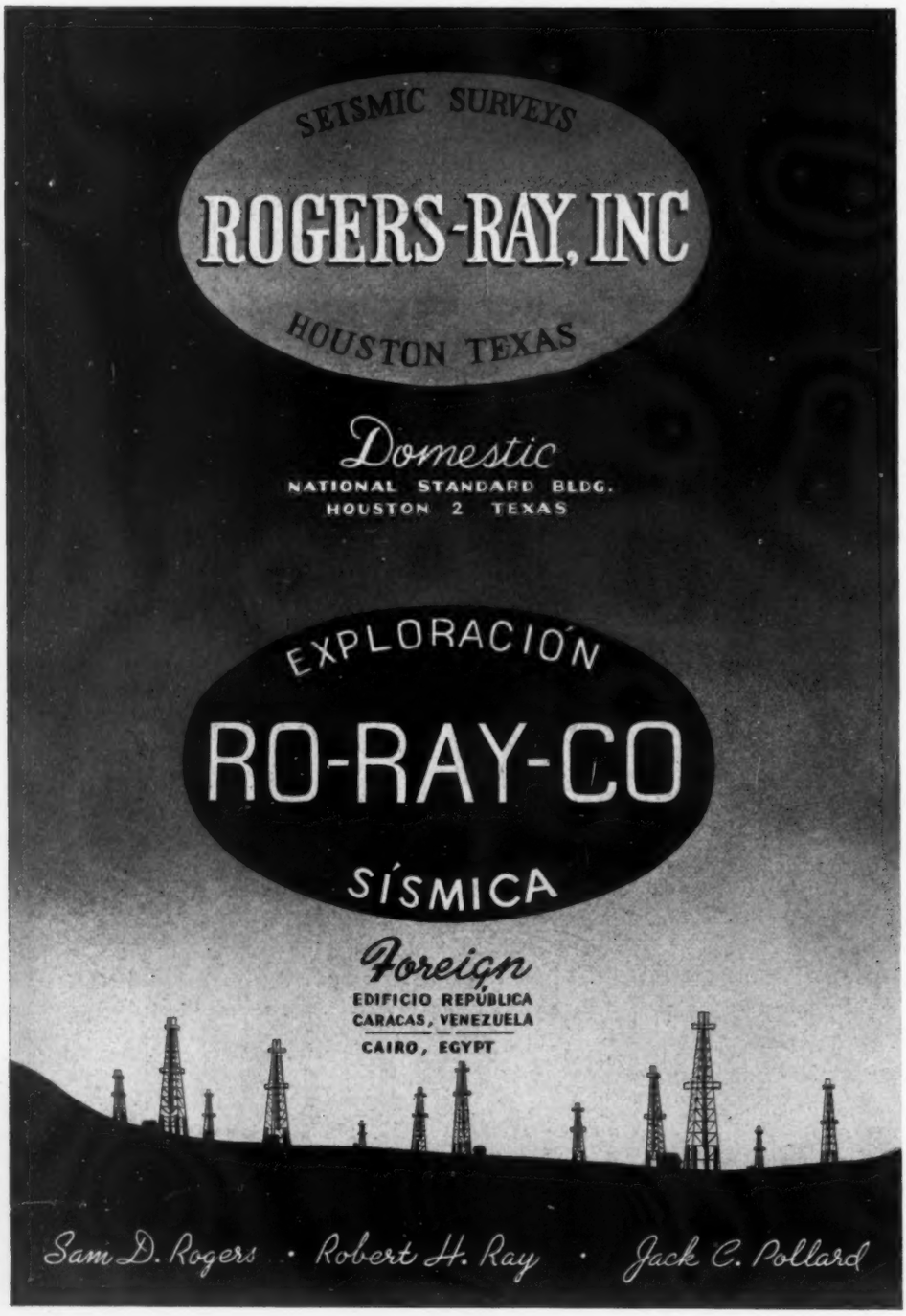
Heads Worthington Exports

S. Riley Williams has been elected vice president in charge of foreign business for Worthington Pump and Machinery Corporation. He joined Worthington in 1920 and until 1941 he resided in Europe, where he was successively managing director of Worthington companies in Spain and France, and general European manager. In 1941 he returned to the United States, and during the recent war served as assistant to the vice president in charge of operations.

HERBERT WILLETTS, manager of the central marketing region of Socony-Vacuum Oil Company, Inc., has been appointed to the newly-created position of national marketing manager. H. T. Ashton, currently manager of Socony-Vacuum's Lubrite Division with headquarters in St. Louis, will be in charge of all the marketing operations of the company in the sixteen midwestern states comprising the company's central marketing region.

KNIGHT C. TEMPLETON, who has for many years been connected with foreign sales of oil equipment, has joined the staff of Roland E. Smith as foreign sales representative, Los Angeles. He will make periodic trips to foreign fields, particularly in South America.

Knight started his petroleum experience with the General Petroleum Corporation production department in 1922. From 1929 to 1939 he was with the Elliott Core Drilling Company in export sales. He transferred to Security Engineering Company then and has been with Security on foreign sales work ever since that time.



Dan Duncan

Emsco Promotes Dan Duncan

Dan Duncan has been appointed executive engineer of the Emsco Derrick & Equipment Company. He will act as coordinator of the various engineering activities of the company. Previously he has been field engineer. Mr. Duncan first entered the oil business in 1921 as a roughneck for the Shell Oil Company in Ventura, where he was soon promoted to driller. His next five years were spent in Sumatra, Dutch East Indies, with an affiliate of the Shell Oil Company. Returning to the States, Mr. Duncan successively worked as field engineer for the National Supply Company, Loffland Brothers Incorporated and Emsco with which he has been associated since 1939.

Traveling in Latin America

Walter H. Porth, manager of the International division, A. O. Smith Corporation, Milwaukee, is traveling through Brazil, Uruguay and Argentina to establish postwar relations with his company's customers and distributors. A. O. Smith manufactures welded steel products ranging from large refinery pressure vessels and penstock pipe for hydroelectric plants to glass-lined tanks, welding electrodes and domestic water heaters. This is Mr. Porth's fourth visit to those countries since his long term residence in the early 1930's in Buenos Aires and subsequently in Rio de Janeiro.

Porter Heads Chemical Construction

Frederick Pope has resigned as president of Chemical Construction Corporation and has been succeeded by Major General William N. Porter. Mr. Pope will continue his connection with American Cyanamid Co.

CLAUDE E. DONALDSON, traffic manager of Shell Oil Company, Incorporated, San Francisco, retired February 1 after 30 years directing traffic. W. H. Adams, Donaldson's associate for 24 years, has been named as Shell's new traffic manager.

Erratum

The photograph published on the cover of the September, 1946, issue of World Petroleum was erroneously credited to Bahrein Petroleum Co., Ltd., owned jointly by Standard Oil Co. of California and The Texas Company. The photograph was taken by T. L. Lenzen, assistant to the vice president for foreign operations of Standard Oil Co. of California, in 1938 when he visited Riyadh in Saudi Arabia.

New Resin From Oil

A new-type synthetic resin from petroleum which can be applied successfully to iron, brass, bronze, aluminum and highly polished metal, in addition to wood and steel, has been developed by laboratories of the Standard Oil Company (New Jersey).

Called A-resin, the substance has excellent qualities of adhesion, flexibility and wetting power which particularly fits it for use on surfaces difficult to paint with ordinary paint. As a baked priming coat on automobiles it is hard, durable, light-fast and chemically resistant. An A-resin can-coating that is only 2/10,000th of an inch thick remains unbroken even when the metal sheets are stamped and punched. It withstands heat up to 250° F. and is unaffected by the extremely high acidity of grapefruit and certain other canned fruit and vegetable juices. A-resin pigmented films air-dry quickly, have good light stability and retain a high and lasting gloss.

S. D. Bechtel

Bechtel Corporation Renamed

Bechtel Brothers McCone Company, engineering and construction organization, changed its name to Bechtel Corporation on January 1. At the same time, three subsidiaries became respectively Bechtel International Corporation; Compania Bechtel, S.A., and International Bechtel, Inc. Principal officers are S. D. Bechtel, president; W. E. Waste, Van W. Rosendahl, J. Perry Yates, V. J. Hindmarsh, Jerome K. Doolan, and C. Stribling Snodgrass, vice presidents.

Cut Plane Refueling Time

A new, faster and safer method of refueling aircraft from beneath the wing of the plane instead of from the top has been developed by Shell Oil Company. The new method, which is three to four times faster than top-of-the-wing fueling, was demonstrated recently at the Glenn L. Martin plant in Baltimore, when the new Martin twin-engine 202, the first plane equipped for underwing refuelling, was serviced by a specially designed Shell aviation truck.

In addition to speed, other advantages claimed for underwing refueling include greater safety, convenience and economy. Delivering fuel to each tank at rates up to 250 gallons per minute, the underwing method can fill new ships which hold up to 14,000 gallons of fuel in a little over 15 minutes. From 45 to 75 minutes would be required to refuel the same ships by the old top-of-the-wing method.

After delivery is complete, fuel in the hose is returned to the truck. To help control static electricity, if either the truck or plane becomes accidentally ungrounded during delivery, an electronic device stops delivery and evacuates the hose.

Send Clothing To Europe

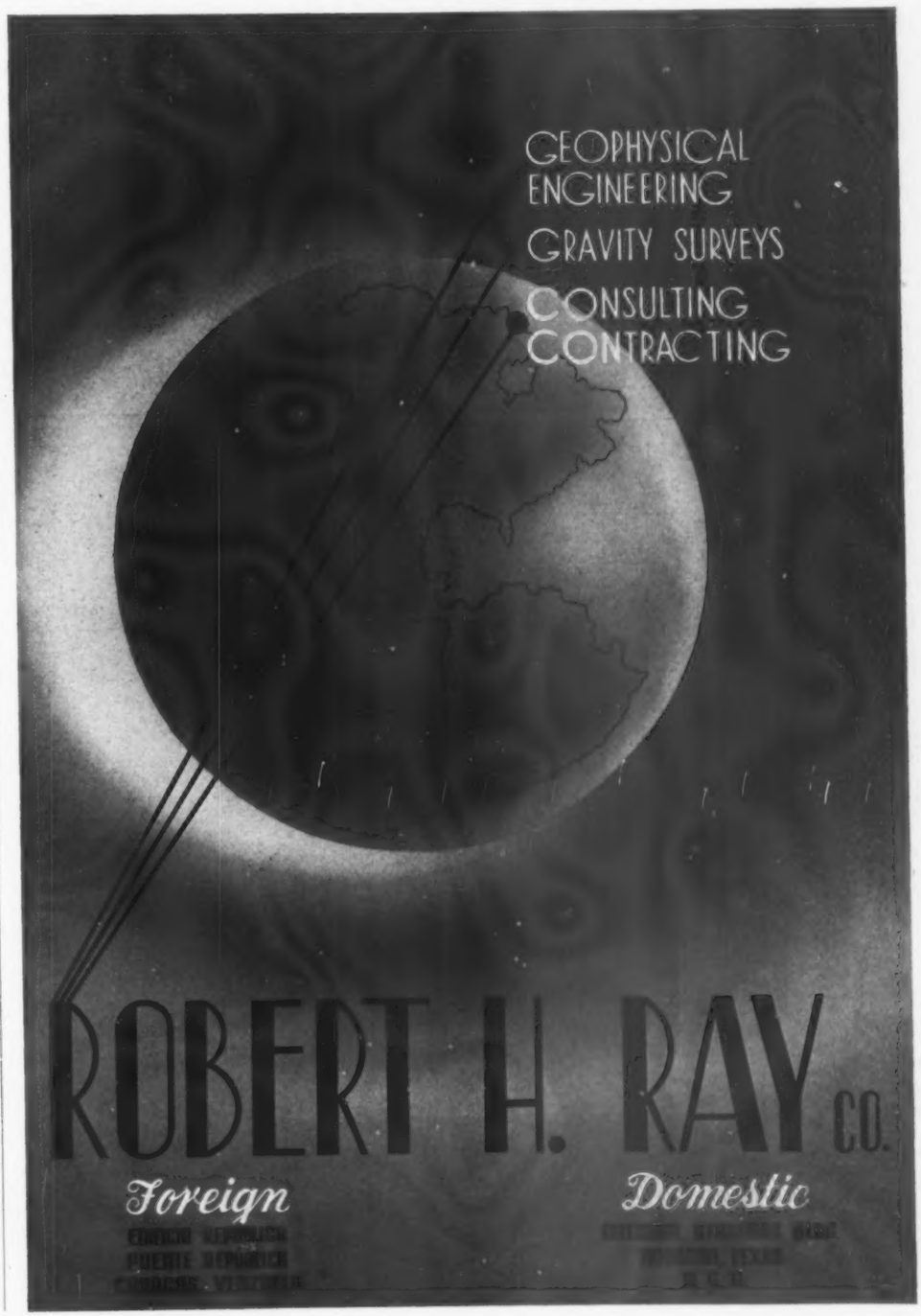
Standard Oil Co. (New Jersey) employees recently conducted a 10-day campaign to gather clothing and shoes for distressed employees and their families in Hungary, Romania and Austria. The Franciscan Fathers have made arrangements to deliver the clothing. Affiliates of the Jersey company have 7,900 employees in the three countries. Last year 18 tons of shoes and clothing were sent to employees in France, Holland, Belgium and the Scandinavian countries as the result of a similar appeal to American employees.

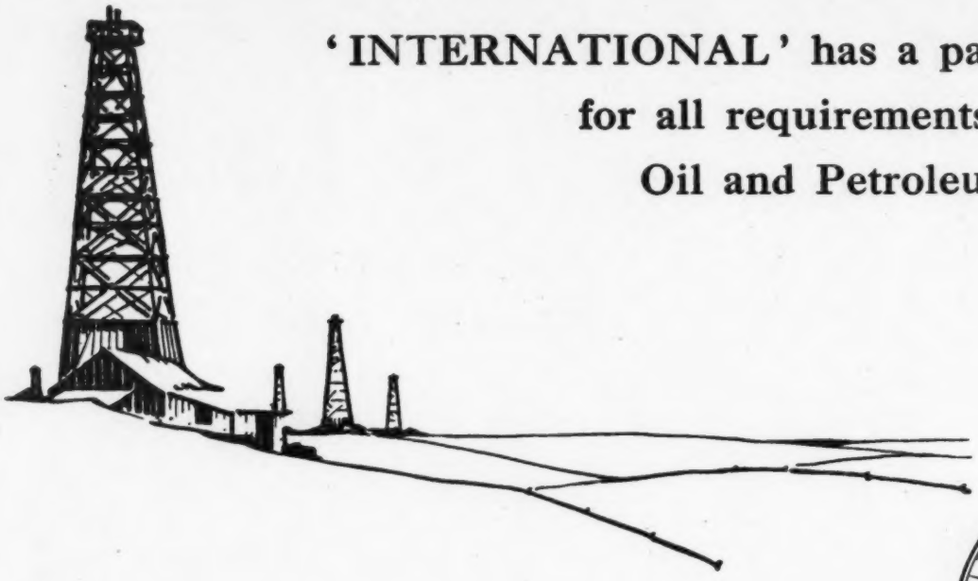
Visits Latin America

Earl G. Ellis, export service manager of the Mid-Continent Cummins Export Corporation, left New York early in February for a three months' trip to Venezuela and Colombia in the interests of Cummins Diesel Engine Sales & Service in that area.

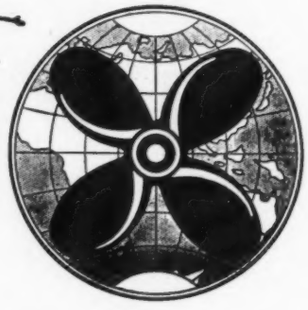
New Oil Field in Louisiana

The California Company has discovered a new oil field in Plaquemines Parish, La. The new structure will be known as the Alliance field. It is located 20 miles south of New Orleans and eight miles east of the Barrataria field. The discovery well, La Citros No. 1, flowed at a rate of 207 barrels a day of clean 38.7 gravity oil through a one-eighth inch choke from a depth of 9700 feet.





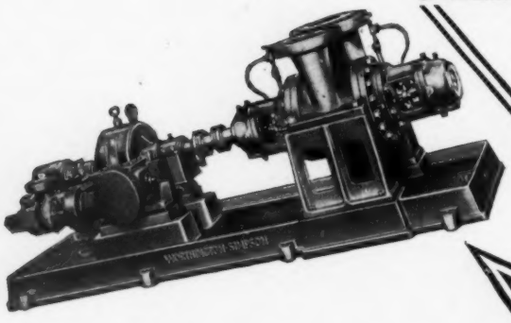
'INTERNATIONAL' has a paint
for all requirements of the
Oil and Petroleum Industries

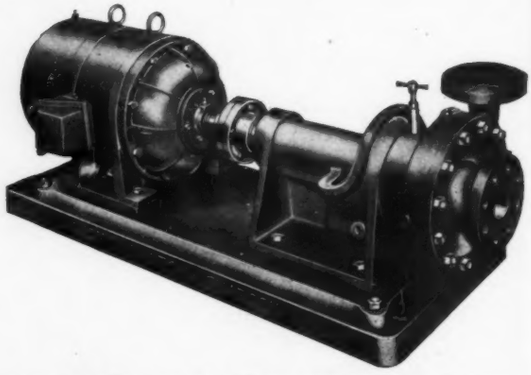


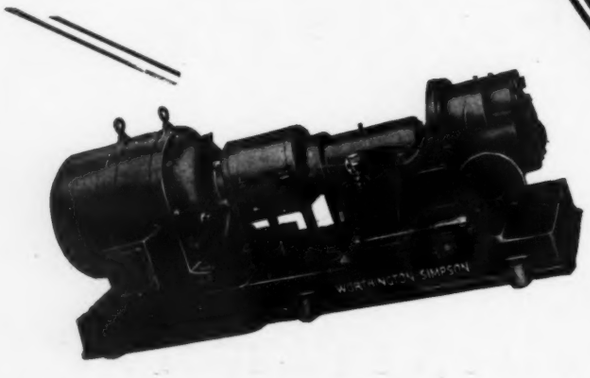
THE INTERNATIONAL PAINT & COMPOSITIONS CO. LTD.
GROSVENOR GARDENS HOUSE,
GROSVENOR GARDENS, LONDON, S.W.1.

WORTHINGTON—SIMPSON

PUMPS FOR
REFINERY SERVICE

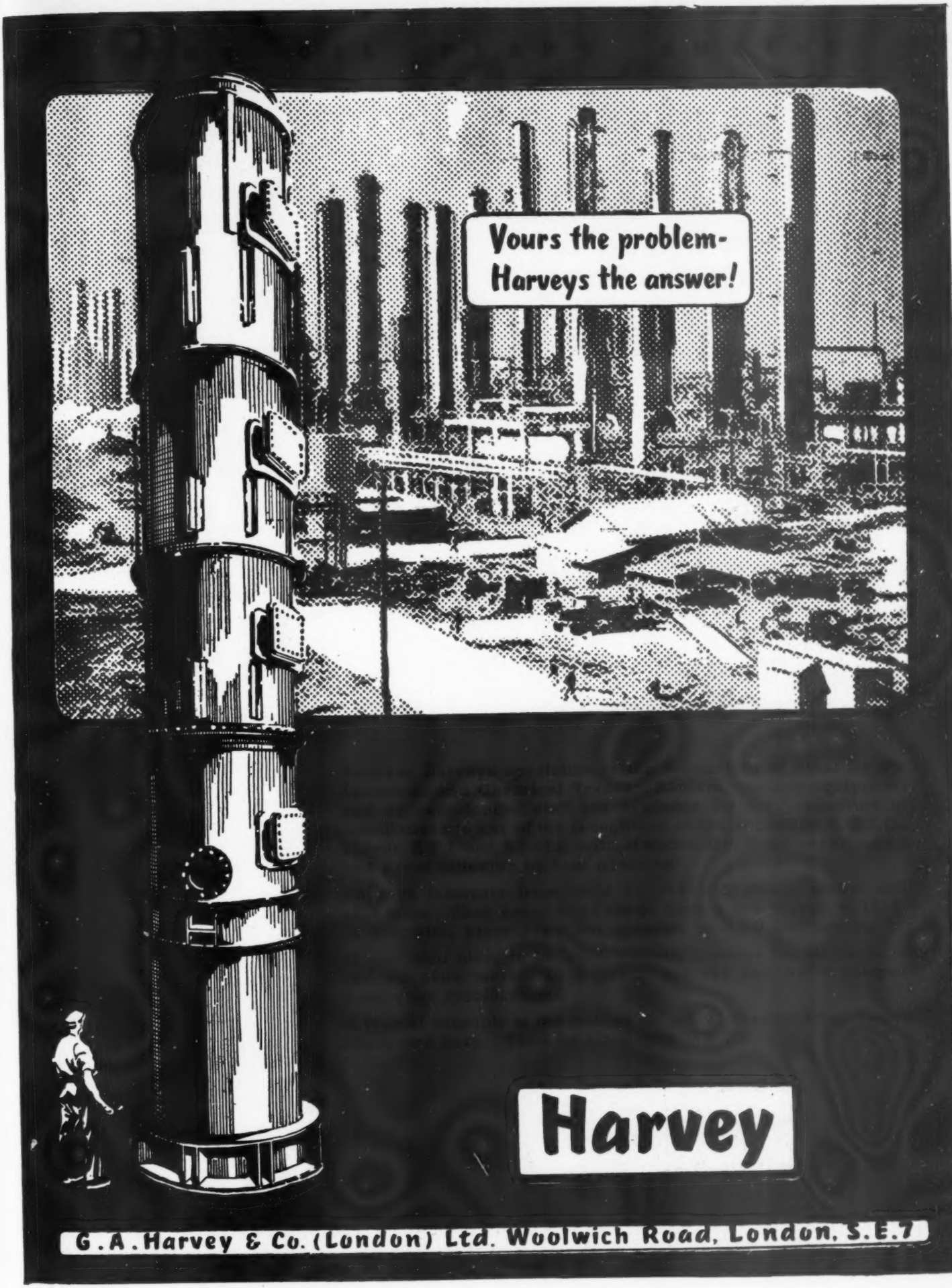






A FULL RANGE OF MODERN CENTRIFUGAL PUMPS, POWER PUMPS, AND DIRECT ACTING STEAM PUMPS FOR ALL PRESSURES AND TEMPERATURES. STEAM JET EJECTORS. DEWAXING AND HEAT EXCHANGE AUXILIARIES.

NEWARK-ON-TRENT


Yours the problem-
Harveys the answer!
Harvey
G.A.Harvey & Co.(London) Ltd. Woolwich Road, London, S.E.7

"Inches" Go To Gas Transmission

Subject to clearance from the Department of Justice and the Federal Power Commission, the "Inches"—Big and Little—have been sold to the Texas Eastern Transmission Corporation. They will be used for the movement of natural gas from Texas and Louisiana to the Atlantic seaboard, and unless the state of Pennsylvania, by legal action now threatened, succeeds in delaying the transfer, they are expected to be put into service under the new management by or soon after May 1.

A noteworthy feature of the transaction is the price of $143,127,000 paid for the lines. This is approximately equal to the amount paid by the government for their construction under wartime conditions. As Robert M. Littlejohn, War Assets Administrator, pointed out in announcing the sale, it is $77,000,000 more than would have been obtained under the best bid submitted last July when the lines were offered with preferential requirement for use in transporting crude oil or products. The price paid for the Big Inch is $77,002,326 and for Little Big Inch, $66,124,674.

Officers of Texas Eastern Transmission Corporation are E. Holley Poe, New York, president, and George R. Brown, Houston, chairman of the board. Other directors are Herman Brown, E. DeGolyer and Charles I. Francis. In addition to the amount paid for the lines, the company expects to expend some $40,000,000 in fitting them for gas transportation including the installation of compressor plants.

F. L. Convers C. J. De Lay

Returns To Active Duty

The Continental Supply Company, Dallas, has appointed Frederick L. Convers vice president in charge of the New York office and foreign operations. Mr. Convers formerly served Continental in the same capacity, having retired in June, 1945. At that time he was succeeded by R. M. Dinges. It was upon the death of the latter that Mr. Convers resumed his old position.

A native of Pennsylvania, Convers spent his early life in the oil fields in the western section of that state. Later he was in Mexico for several years, being in that country until World War I. Immediately following the war, he traveled extensively over the European oil fields.

Returning to the United States, Convers joined the Continental organization in 1920. Except for a period of service with EMSCO Derrick & Equipment Company in New York, his connection with Continental was uninterrupted until the time of his retirement in 1945. He was placed in charge of exports in 1929. Mr. Convers was a charter member of the New York Chapter of Nomads.

Manager of Continental's export division is Charles J. DeLay. Mr. DeLay has held this position since June, 1945, having been with the company since 1919, his first point of service being Wichita Falls, Texas. Mr. DeLay is a native Kentuckian and spent his early years in the oil fields of West Virginia. He is a member of the New York Chapter of Nomads.

F. M. JAYNE and W. K. Minor have been appointed assistant comptrollers of the Standard Oil Co. of California. The appointments fill vacancies created by the promotion of J. E. Norton and W. H. Beekhuis to coordinator of personnel development and economic counsel, respectively. The company now has three assistant comptrollers; the third is W. C. McCammon.

Publishes Technical Bulletin

Enjay Company, Inc., recently organized subsidiary of Standard Oil Co. (N. J.), has published Technical Bulletin No. 101 to describe the effect of Paradyne fuel improver on gasoline performance. Paradyne is an upper lubricant and gum inhibitor to be used as a gasoline additive. Copies of the bulletin are available at 26 Broadway, New York.

JOE
(Superintendent)

BILL
(Toolpusher)

BILL "Say, Joe—how come you took up so much time getting that inclination survey on N.C.B. No. 7? Appears to me as tho your drilling crews must have gone on strike."

JOE "Gosh, Bill, that record came up with a result that just couldn't possibly be right—that is if I know anything about drilling. If that hole had been that much off we'd never gotten the bit out."

BILL "Well, that's what you get for using one of those mechanically operated survey instruments."

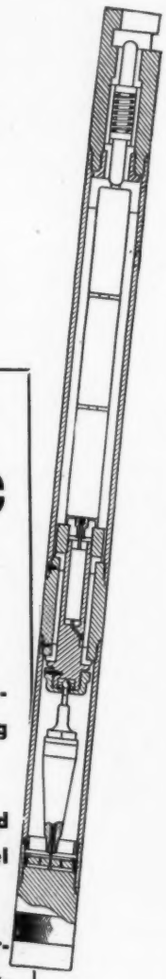
JOE "How come?"

BILL "Because in mechanically operated instruments, you are liable to make a record *before* the plumb bob comes to a standstill. Way off the line!

"Why don't you get wise to the E-C Inclinometer. It records automatically and you can't get a record unless the plumb bob is standing still. So—there's no uncertainty—no new runs necessary—no time lost. That's why operators everywhere are turning to the E-C."

6 WAYS OF USING THE E-C

1. On Measuring Line.
2. On Sand Line.
3. As a Go-Devil and recovered when changing bit.
4. As a Go-Devil and picked up with a core-barrel overshot.
5. Run in with a core-barrel overshot when picking up a core.
6. Run inside of bailer in cable tool drilling.



SPERRY-SUN

SPERRY-SUN WELL SURVEYING COMPANY

Offices: Philadelphia, Pa.; Houston, Corpus Christi, Falfurrias, Marshall, Odessa, Texas; Lafayette, La.; Long Beach, Bakersfield, Calif.; Oklahoma City, Okla.; Casper, Wyo.

STEEL TUBES WITH VICTAULIC JOINTS FOR OIL

The photograph shows part of an installation of 10 in. 'S & L' oil pipe lines with Victaulic joints. Victaulic joints provide valuable flexibility in allowing for expansion and contraction and rise and fall of pipes due to the slight movement of the storage tanks.

Stewarts and Lloyds also specialise in all oil-field tubular goods.

STEWARTS AND LLOYDS, LTD.

GLASGOW BIRMINGHAM LONDON

An Industrial War Record

Stewarts and Lloyds, Ltd., London, have published a beautifully illustrated book of 60 pages reviewing the contributions which the organization made to victory in the war. Title of the book is "An Industrial War Record."

Beginning with a reproduction of the stirring message of the late Sir Allan Macdiarmid to employees after the fall of France in 1940, the book shows detailed views of the plants and products manufactured for war purposes. During the war Stewarts and Lloyds produced 276,000 miles of tubing of which 1,000 miles were used in building "Pluto," another 1,000 miles for oil lines in Britain, 380 miles for "Fido," 15,000 miles for other water and oil pipe lines used in the field as well as 1,200 miles of auxiliary water mains for fire fighting in cities.

The company made thirty million tubular units for shell and bomb bodies. Tubular products were made for boom defenses, supporting bombed structures and construction of army shelters and Iris and Romney huts, to mention only a few. Shell forgings produced a total of 56.7 millions. The 22 company plants employed 9,000 persons during the war.

Describes Services To Industry

Services offered to the petroleum, gas and chemical industries in the period of a post-war reconstruction are described in a new booklet just published by Whessoe Ltd., Darlington, England. The booklet describes the facilities available for construction of ship-built and field-erected tankage, pressure vessels, heat exchangers and other equipment. The Whessoe organization has a works personnel of about 1,000 and produces up to 50,000 tons per year of equipment by newest methods. Equipment for inspection with x-rays and stress relief by heating are provided. Copies of the booklet are available on request to the London offices at 25 Victoria St., S.W.1.

WILLIAM LESLIE FORSTER, former general manager of the Cia de Petroleo de Colombia, has been named general manager of the Caribbean Petroleum Company and of the other companies of the Royal Dutch Shell group operating in Venezuela. In this capacity, he succeeds John H. Loudon who has been made a managing director of the Royal Dutch with headquarters at The Hague, Holland.

Mr. Forster has been with Shell since 1925. His first position was in Mexico where he served for three years. In 1929 he went to Romania and remained there until 1940, when he became acting manager of Anglo-Egyptian Oilfields, Ltd. He entered the British Army and saw service in Burma where he won the C.B.E. In 1943 he was detailed to the Joint Allied Chiefs of Staff in Washington and received the American Merit Award. In the following year he became head of the economic section of the British Military Mission to Romania. Leaving military service with the rank of Colonel, Mr. Forster became manager of Shell's operations in Colombia, from which post he has now been transferred to Caracas.

Venezuelan Production

Production of crude oil in Venezuela during the month of December amounted to 33,687,868 barrels, an average of 1,086,705 barrels daily. As compared with November, this daily average is lower by 31,972 barrels. Exports for the month were 28,726,209 barrels. Production by companies is shown in the following table:

Company	Western	Eastern	Total
Creole	11,811,588	4,601,846	16,413,434
Mene Grande	1,738,911	4,340,765	6,079,676
Shell	9,383,369		9,383,369
B. C. O.	33,005		33,005
Orinoco	8,210		8,210
Phillips		5,652	5,652
Socony		855,049	855,049
Texas		183,041	183,041
Consolidada		712,688	712,688
S.A.P. Las Mercedes		5,745	5,745
Atlantic		7,999	7,999
Totals	22,975,083	10,712,785	33,687,868
Exports	21,071,334	7,654,875	28,726,209

Romanian Production Declines

Production of crude oil in Romania in 1946 is reported as 4,250,000 metric tons (29,750,000 barrels), a small decline from the 1945 output of 4,350,000 tons. Exports during 1946 were 2,350,000 metric tons as compared with 3,170,000 in 1945, and domestic consumption of oil products was 1,550,000 tons.

Tide Water to Install Desalter

The Tide Water Associated Oil Company will install a high capacity Petreco electric desalting unit at the Avon refinery. The proposed desalter is to be fully automatic and is designed to handle 25,000 barrels per day of Ventura crude. This is the first high capacity Petreco desalter to be installed in the San Francisco Bay area.

...ograph shows one of many heat exchangers produced in the Whessoe works. Whessoe are fully equipped for the output of high duty tubular heat transfer units. Processes include radiography and stress relieving, as required by construction codes.

Whessoe Limited, Head Office and Works, Darlington. Tele : Darlington 5234 Cables : Whessoe, Darlington.
London : 25, Victoria Street, S.W.1. Tele : Abbey 3881. Cables : Whessoe, Sowest, London.

WHESSOE
DARLINGTON

General Chemical Research Presents

BASIC CHEMICALS

GENERAL CHEMICAL COMPANY

FOR AMERICAN INDUSTRY

Sulfan*

Brands of STABILIZED SULFURIC ANHYDRIDE

General Chemical Company—America's pioneer with the Contact Process for manufacture of high strength sulfuric acid and oleum—makes another major contribution to Basic Chemicals for American Industry with SULFAN . . . Anhydride of Sulfuric Acid.

By perfecting new methods of stabilizing Sulfur Trioxide, General Chemical Research takes an invaluable chemical tool off the shelf of laboratory curiosities and brings it to the Process Industries as a chemical of commerce for use in a host of ways.

General Chemical offers SULFAN in three chemically equivalent forms:

Sulfan 'A' Partially Stabilized, melting at approx. 35°C;

Sulfan 'B' Completely Stabilized, melting at approx. 17°C; and

Sulfan 'C' Unstabilized.

Experimental samples and further technical information are available on request from General Chemical Company, Research and Development Division, 40 Rector Street, New York 6, N. Y.

Some Potential Uses

1. For fortification of spent oleum, making possible a ready supply of any strength oleum.
2. In benzenoid sulfonations for elimination of mixed sulfonates: meta- only or ortho- and para- derivatives only are formed.
3. For di- and poly-sulfonations of aryl compounds.
4. For direct sulfonation of aliphatics.
5. For sulfonations in the presence of a solvent, thus eliminating the removal of H_2SO_4 necessary when oleum is the agent.
6. For formation of addition compounds with amines, valuable in organic synthesis.

Sulfuric Anhydride exists in three chemically equivalent physical modifications as indicated by data below. General Chemical's stabilized product is almost entirely Gamma-Form and its partially stabilized product is largely Beta-Form.

PROPERTY	GAMMA-FORM	BETA-FORM	ALPHA-FORM
Description	Ice-Like	Asbestos-Like	Asbestos-Like
Equilibrium Melting Point (°C):	16.8	32.5	62.3
Density (20°C)	1.9255	—	—
Sp. Ht. (cals/gm) (20°C)	0.77	—	—
Ht. of Fusion (cals/mol)	1,800	2,900	6,200
Ht. of Sublimation (cals/mol)	11,900	13,000	16,300
Ht. of Dilution (cals/mol)	40,340	—	—
Vapor Pressure (mm.)			
0°C	45	32	5.8
25	433	344	73
50	950	950	650
75	3,000	3,000	3,000

GENERAL CHEMICAL COMPANY

40 RECTOR STREET, NEW YORK 6, N. Y.

Sales and Technical Service Offices in principal cities from coast to coast

*Trade Mark, General Chemical Company

Secretary Krug Discusses Future Supplies

(Continued from page 82)

laid before the industry advisory group requests for the appointment of committees to advise with the Department on the nature and types of world-wide oil and gas information that should be gathered and made available to the government, the public and the industry.

The committees also would work with the government on factual studies of a number of special problems, such as transportation of petroleum and petroleum products by rail, truck, pipe line, barge and tanker, availability of fuels for military aircraft, and international standards of measurement for aviation products. The Under Secretary emphasized the government's need for industry assistance and advice in collecting and analyzing fundamental information in the interests of the public and of the industry itself.

Walter S. Hallanan, president of Plymouth Oil Company, who has been serving the Council as temporary chairman since its organization last June, accepted the job on a permanent basis. In accepting the post, Hallanan recalled that the industry met the challenge of war in a way that few men dreamed could ever be done and succeeded by "sincere cooperative effort with government." He said that "in meeting the problems of peace, we propose to continue that same teamwork which was so fruitful in time of war."

Continuing he said: "With the exercise of prudence and the adequate safeguards which surround the organization of the council, I am certain that we can integrate ourselves to a legitimate consideration of matters in which the government seeks our advice and cooperation, and at the same time strengthen the position of our industry in relation to the public welfare."

Magnolia Testing Offshore Formations

(Continued from page 61)

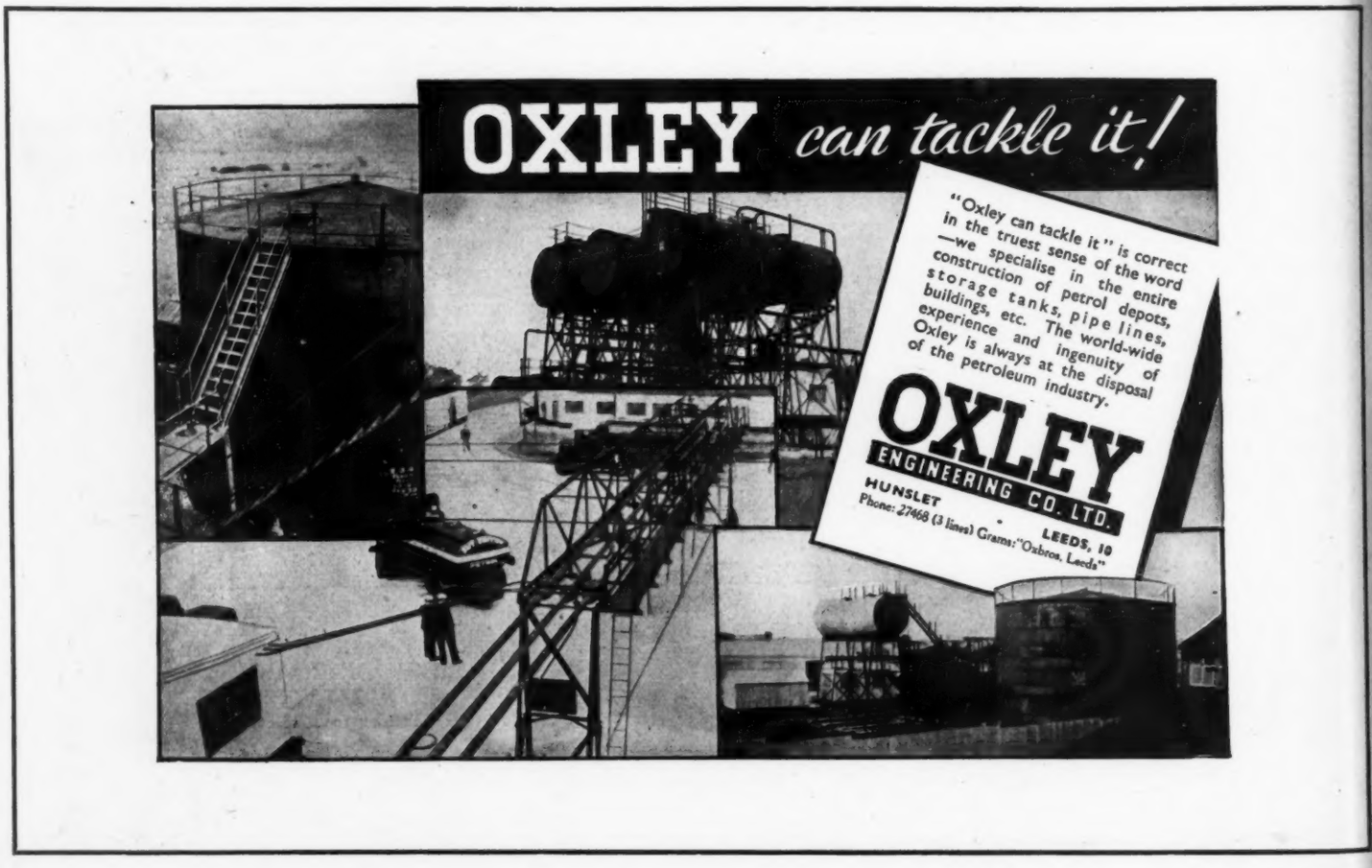
Some idea of the size of the transportation problem may be obtained from the fact that there are three large diesels to run the rig and an auxiliary diesel to run a light plant, air compressors and hoisting equipment, and that there is a light plant and other power equipment on the quarterboat. It is necessary to transport from the shore the 500 barrels of fresh water daily used on the rig. There is a water well at the rig, but it is inadequate and the water is brackish. In addition, all of the supplies used by the quarterboat and on the seismograph boats must be transported from the shore.

Working conditions on the job are adapted to the unusual situation. The men on the rig work twelve hours a day for four days and then have four days off—time enough to go ashore and usually to their homes. The working arrangements aboard the seismograph field boats are different. The field crew works ten days and then has five days off. Their actual working hours vary with the season, being from dawn to dusk. There is a company rule that prohibits seismograph work (which employs explosives) after nightfall. During the ten-day tour of duty the field men do not leave their boats, which are shrimp "schooners," actually diesel and gasoline-engined powered trawlers. The exception is when the boats are near enough to the quarterboat to put in for a cooked meal at a dining room table and a brief period of recreation.

U. S. Motor Fuel Quality

Knock rating of regular gasoline was up 4.7 octane numbers to 74.4 in the United States last summer when compared with the summer of 1945 but was down 1.5 octane numbers when compared with the winter of 1945-46. Premium gasoline octane number was up 3.4 octane numbers to 78.3 compared with the previous summer but down from the 80.9 level reached the previous winter. Cause of the drop from the previous winter was the shortage of lead.

The U. S. Bureau of Mines collected 3,011 individual samples of gasoline last summer in all parts of the country to prepare the survey. Work was in cooperation with the Coordinating Fuel Research Committee of the Coordinating Research Council, Inc. Complete copies of the report are available from the Bureau of Mines in Report of Investigations 4063.


OXLEY can tackle it!
"Oxley can tackle it" is correct in the truest sense of the word —we specialise in the entire construction of petrol depots, storage tanks, pipe lines, buildings, etc. The world-wide experience and ingenuity of Oxley is always at the disposal of the petroleum industry.
OXLEY
ENGINEERING CO. LTD.
HUNSLET
LEEDS, 10
Phone: 27468 (3 lines) Grams: "Oxbros, Leeds"